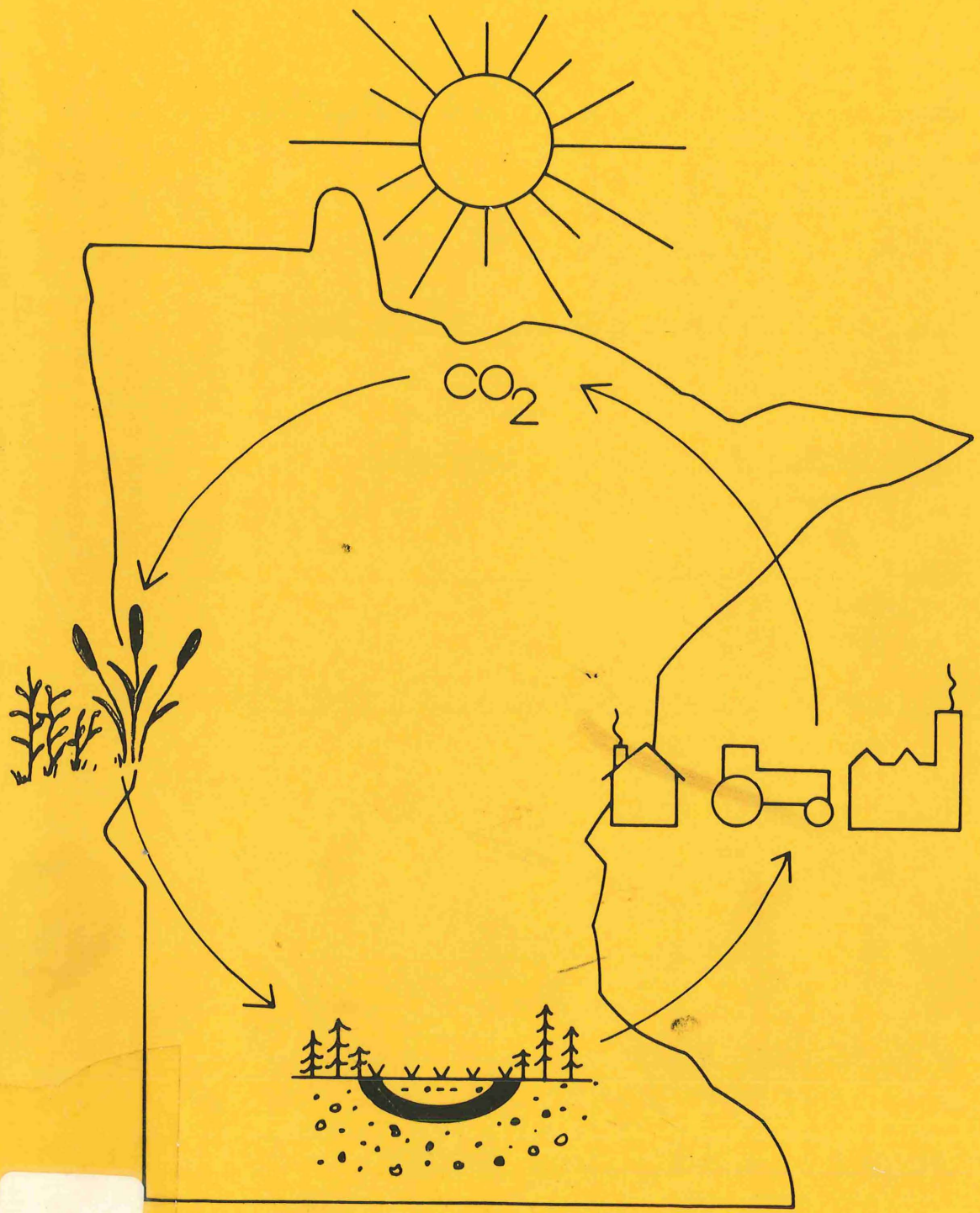
NERGY IN MINNESOTA



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A REPORT TO THE
LEGISLATIVE COMMISSION ON
MINNESOTA RESOURCES

PEAT SPECIAL ENERGY PROJECT

INTER-AGENCY PEAT TASK FORCE

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SUMMARY

This report to the Legislative Commission on Minnesota Resources (LCMR) presents a proposal for bio-energy research in Minnesota. The proposal has been developed as a cooperative effort by the Inter-Agency Peat Task Force, and contains input from each department, as well as input from the public. The results of the proposal refinement process and public input process are also contained in this report. They include:

1. Two cycles of technical review of the proposal draft.
2. Public review of the draft proposal.
3. A bio-energy media campaign in Northern Minnesota.
4. Five public input meetings.
5. A survey of public attitudes toward bio-energy.
6. Mapping of available peatlands.

The research is intended to provide basic data on the use of peat/biomass for energy. Previous work has centered on large scale development, which may or may not be appropriate for Minnesota.

This proposal differs from existing peat and biomass studies in that its goal is to produce biomass materials on a reasonable scale, test those materials for energy conversion, and measure the environmental impacts of the production systems. Minnesota production and conversion costs for these resources can thus be meaningfully estimated, prior to any peatland leasing decision that will lead to significant peatland energy production.

A discussion draft of the Bio-Energy Proposal was developed by the Inter-Agency Peat Task Force and was available for public comment on September 15, 1981. The Energy Division coordinated the

development and review of this draft. Sections of the proposal were written by each member of the Task Force. The draft proposal became the initial position of the Inter-Agency Peat Task Force.

The Energy Division assigned a staff person to develop public awareness of the bio-energy research effort in the State. Approximately two months were spent with reporters from newspapers and radio and TV stations in both the metro and out-state regions. Reporters were assisted in scheduling interviews with researchers at the University of Minnesota, IRRRB, and other State agencies. Feature articles in many newspapers, and numerous radio and TV programs, resulted. A scrapbook has been assembled from news articles generated, and many of the TV segments are available on videocassette tape.

Public meetings to review the proposal were hel in five cities in the peatland region. Those cities were: Thief River Falls, Aitkin, International Falls, Bemidji, and Hibbing. The meetings were attended by over 180 people. The meetings were recorded and used to refine the draft proposal.

A telephone survey of the public was conducted to assess the impact of the public meetings and media effort. The survey focused on awareness of biomass energy options and how research to develop these options should be funded.

The Minnesota Peat Program has identified, through its computer mapping activities, between 200,000 and 300,000 acres of deep, available and accessible peat. These peatlands could be leased in 3,000 acre units by the State to private sector producers, if environmental and other rules are satisfied. The Inter-Agency Peat Task Force be

lieves this resource and our State policies, provide the State with the opportunity for the kind of peat-based energy industry thriving today in northern Europe.

Minnesota has access to enough renewable resources to provide 3.7 times the current level of energy demand. In addition, the State has peat and district heating potential to supply all of the State's energy needs for forty-nine years. Upon conversion to usable energy forms, these resources may provide direct cost savings to Minnesotans, as well as indirect benefits in the form of increased economic activity.

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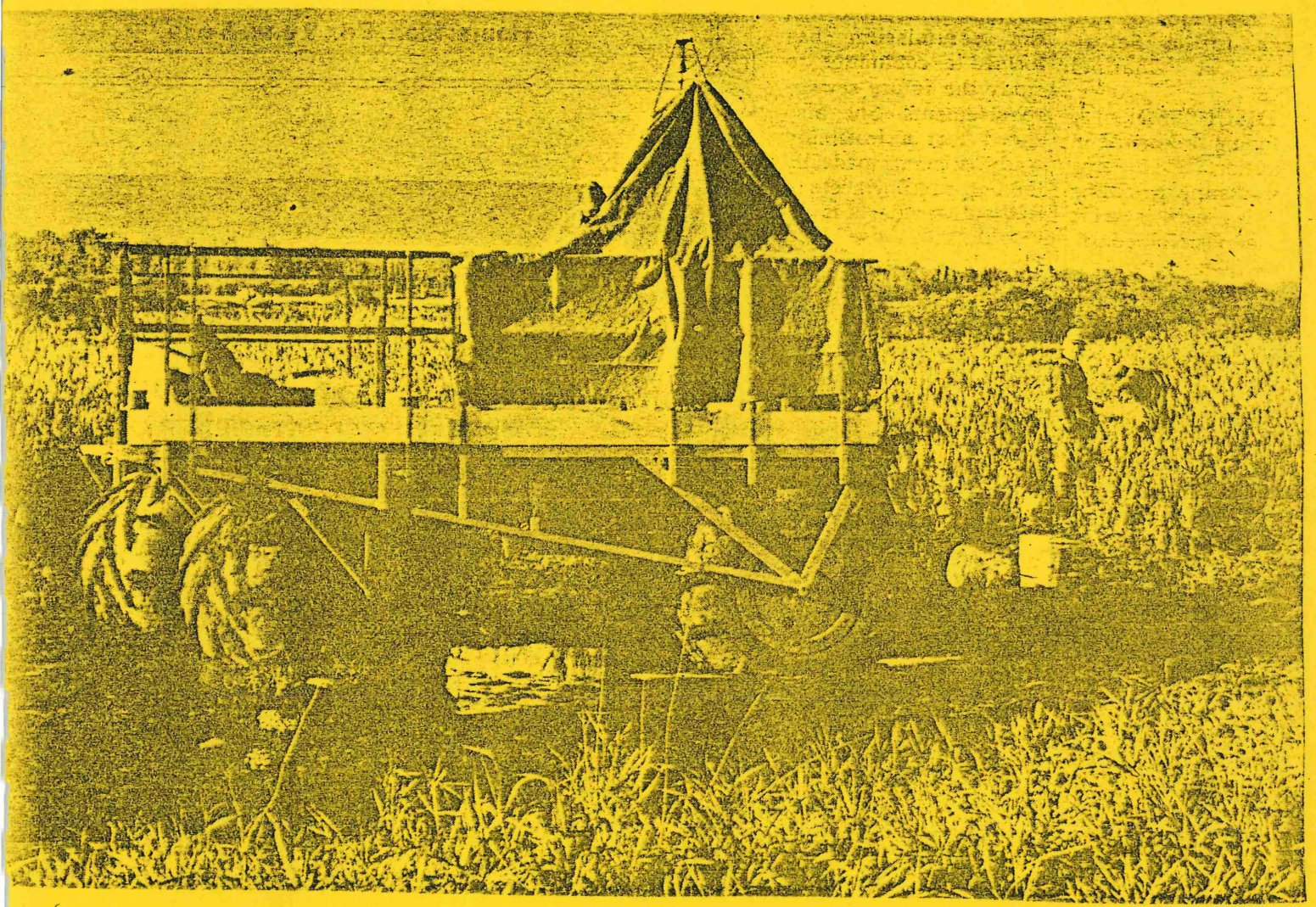
I.

BIO-ENERGY RESEARCH IN MINNESOTA (PROPOSAL)



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ABSTRACT

The objective of this proposal, presented by the Inter-Agency Peat Task Force, is a project to develop the Minnesota peatlands and wetlands for biomass energy production.

This project differs from existing peat and biomass studies in that its goal is to produce biomass materials on a reasonable scale, test those materials for energy conversion, and measure the environmental impacts of the production systems. Minnesota production and conversion costs for these resources can thus be meaningfully estimated, prior to any peatland leasing decision that will lead to significant peatland energy production.

Overall project management will be the responsibility of the Department of Energy, Planning and Development. The Department of Natural Resources, the University of Minnesota, and DEPD will have task management responsibilities for work including environmental measurement, excavation, harvesting equipment construction, and economic analysis. The proposal covers two years' effort, but it fits into a ten year development program. The total State cost will be approximately $1,760,000 for the biennium.

The information generated from this study will provide a broad data base of information dealing with many aspects of the biomass energy issue. These results will assist State decision-makers in their efforts towards resolving Minnesota's energy problem. In addition, basic data will be provided for those who wish to become commercially involved in the emerging bio-energy industry. As such, this project will be of great benefit to the State as a whole.

1.0 INTRODUCTION

The State of Minnesota has 5.2 million acres of peatlands and 3.5 million acres of wetlands. One of the major policy questions facing the State is what to do with these lands. Should the State advocate leaving all of them in their natural condition; or should it encourage using part of them for other purposes, such as agriculture, forestry, mining, or as land for growing special energy crops?

This proposal, developed by the Minnesota Inter-Agency Peat Task Force, presents a plan to develop the peatlands/wetlands for biomass energy production. The plan covers pilot-scale land preparation for biomass production, growth and productivity studies of biomass crops on peatlands/wetlands, an environmental impact assessment, a wetlands inventory, and site selection. It blends various efforts into a coordinated structure, which will yield the answers necessary for sound land-use policy decisions.

Providing sufficient energy to support the Minnesota economy, through either traditional fuels or synthetic fuels derived from coal, will continue to result in a significant drain of dollars from Minnesota to other states and nations. To compensate for this dollar drain the state has to increase production of agricultural, mineral, forestry and manufactured goods. Increases in these sectors will be difficult to achieve because of resource limitations and the negative influence of high fuel costs. A competi-

tive, renewable-fuel industry, in Minnesota and economic development based on Minnesota's traditional industries could provide support for each other. Development of a renewable-fuel industry would also increase employment opportunities in areas of the state where they are desperately needed.

Studies by the Energy Division of the Department of Energy, Planning and Development have shown that with present biomass technologies, substantial and workable renewable-energy systems are possible in Minnesota within a short time. Although Minnesota cannot produce large percentages of its energy needs from agricultural or forest lands on a sustainable basis, the 5.2 million acres of organic soils (peat) located in the northern part of the state represent a significant opportunity, as do the 3.5 million acres of non-peat wetlands.

Peat is an alternative fossil-fuel source that could be mined. Significant amounts of synthetic fuel could be produced from peat feedstock, although long term production would be limited by peat's non-renewable nature and by mining economics. More importantly, peat is also a soil that could be used for growing biomass. Biomass can be converted into the same fuels as the original peat, and it is renewable.

The lack of uniformity in Minnesota peatlands is a major consideration. Not all peatlands are peatbogs. Some contain a mixture

of organic soil (peat) and wet mineral soils. This soil mixture is often scattered throughout any peatland region. Secondly, peat depths vary considerably within any given land area.

The State owns about fifty percent of the available peatlands, along with the majority of the wet mineral soil areas, and is thus in a position to control major wetland development. Since the State also implements environmental laws governing the use of Minnesota's resources, it is interested in the many effects of resource production and conversion. It is also interested in the engineering needed to develop conversion technologies, such as gasification. These two elements must be coordinated so that all effects of a total system can be defined when leasing decisions are made.

The plan presented in this document could lead to energy production that is environmentally sound. Biomass production should be the long-run outcome of any peatland/wetland development. Seeking ways to make long-run productivity as great as possible is a worthwhile goal.

2.0 CURRENT STUDIES

Current work on Minnesota bio-energy is being conducted by State agencies and the University of Minnesota. The federal government is sponsoring additional work in conversion technology. The Inter-Agency Peat Task Force was organized to coordinate these studies.

2.1 Other Federally Supported Efforts

The U.S. Department of Energy has sponsored several large studies of peat gasification through Minnegasco and the Institute of Gas Technology (IGT). This work has concentrated on conversion technology assuming that a satisfactory resource could be made available. Work has proceeded from laboratory-scale gasification tests to pilot-scale tests currently underway at the IGT. The DOE supported work is aimed at determining whether the gasification process can be commercially feasible. DOE has also supported a minor amount of work on lab-scale biological conversion of peat to methane gas and lab-scale gasification of biomass.

The U.S. Bureau of Mines completed a small amount of work on mining and dewatering technology. This work consisted of a single test and did not lead to any positive conclusions. Its results cannot be used as a basis for moving to a commercial-scale operation.

Minnegasco has received a $4 million grant from DOE for a feasibility study of a peat gasification system. Their study will

be completed in early 1982. It should provide the basis for a federal determination of whether to proceed with a demonstration of peat gasification, if DOE remains interested in these kinds of activities.

The federally supported work could lead to pressure for construction of a commercial-scale gasification facility in Minnesota. A major question facing the State is whether it wants to support that sort of construction, or smaller, diversified, renewable systems. Past federal efforts can be characterized as a concentration on conversion technology with little or no emphasis placed on resource questions. It is, of course, these resource questions which are of primary interest to Minnesota.

2.2 State of Minnesota

The State of Minnesota, triggered by a Minnegasco lease request for peatlands, initiated studies of peatlands in 1976. These studies developed a baseline by measuring existing conditions. Work included an inventory of resources, measurements of environmental conditions, estimates of the economic effects of peat utilization, and research on legal aspects of the utilization of peat. The studies led to preliminary policy alternatives, which were considered by the Minnesota Legislature in 1978. Further studies of reclamation, inventory, and alternative uses, and development of more precise environmental measurements have been initiated.

In another project, the Iron Range Resource and Rehabilitation

Board (IRRRB) purchased and installed a small-scale, low-Btu gasifier. They plan to experiment with this system by using peat and combinations of peat and biomass, such as wood chips. The object of this work is to determine whether low-Btu gasification can be practical for a community-scale, cogeneration system.

2.3 University of Minnesota

During this same period, the University of Minnesota, supported by the U.S. Department of Energy (DOE) and the State, was investigating the growth and productivity of both wood and herbaceous biomass crops on peat and mineral soils. The University Soil Science Department undertook a major DOE project to evaluate the growth and productivity of woody biomass species. The College of Biological Sciences, supported by the State of Minnesota and DOE, has been investigating the growth, productivity and chemistry of wetland plants for energy purposes. The plants receiving the most intense study are the common cattail, willow, alder and hybrid poplar. The current study effort is divided into four major topics: growth and productivity of the plant material, plant bio-chemistry, harvesting, and an analysis of the land areas that might be used to grow wetland plants.

During the summer of 1980, the work on both wetlands and woody biomass expanded greatly. The University of Minnesota developed propagation techniques for woody biomass that has allowed the researchers to move to acre-size plots. Several large areas of

willows have been planted at the IRRRB research farm at Zim. The wetlands plant work has been expanded at both Godward's wild rice farm, north of Aitkin, and at Zim. During 1981, 2.5 acres were prepared at Zim for studies of growth and productivity. In 1982, 2.5 additional acres will be available. The research on both types of species is now at the "field station" stage, and it is expected that plot sizes will increase dramatically in the future.

2.4 Information Expected From the Current Studies

Studies supported by the state and federal governments will yield information in the following areas:

1) Location of peat resources - Inventory work will define surface locations of peat resources and the approximate quantity of the resource available.

2. Peatland locations that should be left in a natural state - Certain bogs should be preserved because of their unique characteristics. These areas, of course, subtract from the resource base available for other purposes.

3. Existing environmental conditions in peatlands - Current studies have developed extensive data on baseline water chemistry, vegetation and wildlife characteristics in peatlands. This data will be used to evaluate the environmental effects of potential use.

4. Gasification of peat using one conversion technology -

Gasification work supported by DOE has concentrated on the "PEATGAS" process developed at IGT. Other conversion technologies, which could yield gas, liquid or solid fuels, have not been investigated at this level of detail.

5) Conceptual analysis of peat mining, dewatering and gasification - Current feasibility studies by Minnegasco will provide a conceptual basis for one peat gasification system. The conversion technology portion of this study will be supported by empirical data, but the mining and dewatering portion will not, since little field work is underway.

6) Growth and productivity of cattails and other species on peat soils and in natural stands - Current work should define the potential size of several types of renewable biomass resources. It can be thought of as the first phase in the development of a new industry.

7) Bio-gasification of biomass in laboratory scale equipment - A small amount of work is underway at IGT on the anaerobic digestion potential of some forms of biomass.

2.5 Information Not Provided by the Past or Current Work

Several important information areas are virtually untouched in past efforts. The most important of these areas are:

1) Methods for, and environmental effects of, peat mining, dewatering and transportation;

2) Biomass growth in large managed stands and the associated

environmental effects;

3) How to combine peat mining and biomass production in order to optimize biomass growth;

4) Gasification of biomass and peat/biomass combinations, as well as conversion to liquid and solid fuels;

5) Analysis of methods for selecting a "best" energy production strategy using peatlands in the State of Minnesota.

3.0 POLICY SUMMARY

Peatlands are a valuable resource, capable of serving many uses, including horticulture, agriculture, forestry, energy, industrial chemicals, sewage treatment, recreation, scientific study, wildlife habitat, water filtration, and preservation. The Inter-Agency Peat Task Force recommends that peatlands be managed cautiously so that the resource can be used by future generations, and flexibly to allow for changing needs and expanded knowledge.

3.1 Peatland Uses

3.1.a. Peatland Protection and Preservation

Peatlands that have high potential for forestry, wildlife management, or natural area preservation should be preserved for such uses and not be offered for lease. The potential of peatlands for forestry should be considered when evaluating lease proposals. Existing and proposed wildlife management areas should be protected from incompatible development. The value of peatlands as wildlife habitat should be one of the criteria used to evaluate proposals for leasing peatlands outside of existing or proposed wildlife management areas.

Peatlands that contain endangered, threatened, and rare peatland fauna and flora, representative types of peatlands, and areas that have unique geomorphic features should be set aside. Peatlands that have significant scientific value are now under study by the Task Force.

These peatlands should not be used until the appropriate management of these areas is determined.

3.1.b. Leasing

Peatlands available for leasing should be allocated for many uses so that the needs of a variety of developers can be met, and particular uses demonstrated.

3.1.c. Development Siting

Criteria to select peatlands for leasing include development interest, existing and potential use, available resource information, availability of transportation and utilities, existing disturbances, location in the state, peatland and watershed, and potential environmental effects.

3.1.d. Conflicting Uses

Certain uses of peat will preclude other uses. The need to set priorities on extractive uses presently does not exist, given the current supply and demand. Should major use conflicts arise, it will be necessary to study and recommend the appropriate use.

3.1.e. Size

As a guideline, leases should not exceed approximately 3,000 acres (approximately five square miles) of peatland. The size of each lease should be based on the peatland, the watershed, and the mining method.

Leases for larger-scale development should not be granted until the technological, economic and environmental feasibility is well doc-

umented and demonstrated.

3.2 Environmental Management

3.2.a. Rules

It is recommended that the rules of the Environmental Quality Board be amended to require a mandatory Environmental Assessment Worksheet for:

1) conversion of 640 or more acres of peatland to an alternative use,
2) for the construction of a facility using 5,000 dry tons or more of peat per year to produce a fuel, and
3) for the construction of a peat mining operation which will use 160 or more acres of land.

It is recommended that an Environmental Impact Statement be required for the construction of:

1) a facility using 250,000 dry tons or more of peat per year to produce a fuel, and
2) a peat mining operation which will use 320 or more acres of land.

3.2.b. Permits

In order to protect the resource, as well as the public health, safety, and welfare of the people of Minnesota, drainage of all peatlands should be subject to water permit rules promulgated under Minn. Statutes, Chapter 105, and other applicable legislation, and the water quality rules of the Pollution Control Agency. Rules have been pro-

mulgated for appropriation of waters of the State that pertain to peatland.

Peatland development projects should also be subject to other applicable rules of the Pollution Control Agency regarding air quality.

3.2.c. Mitigation

Mitigation of potential adverse environmental effects should be required to protect water, wildlife, and air, and the public's health, safety and welfare.

3.2.d. Monitoring

Monitoring of air, water and land should be required in all leases. Before a lease is granted, an approved monitoring plan should be required. The lessee should be responsible for conducting or providing for all required monitoring.

3.2.e. Reclamation

To ensure the future land-use capability of peatlands, and to protect downstream and adjacent resources, reclamation should be required on lands disturbed by peat development activities.

To ensure adequate reclamation, a bond, security or other assurance should be required when there are reasonable doubts as to the operator's financial and technical ability to comply with the reclamation plan.

Reclamation should be staged over the term of a lease to enhance the process of reclamation and to reduce the environmental effects on

unused disturbed peatlands.

3.2.f. Leasing

1) Rents and Royalties

So that the State receives an adequate return for the resource, both rents and royalties should be charged for extractive uses. Only rents should be charged for nonextractive uses.

Royalties should be indexed to fluctuate with the rate of inflation so that the return to the State is commensurate with current dollars.

2) Competitive Bidding

Leases greater than 160 acres should be awarded through competitive bids. Minimum rents and royalties should be established so that the State receives the maximum return for the use of the resource. Negotiated sales may be employed for lease expansions when only singular interest or use is documented.

3) Speculation

Peatland speculation should be discouraged by requiring a certain amount of development to be performed on a leased area within a prescribed time.

4.0 DEVELOPMENT OF THE BIO-ENERGY RESEARCH PROPOSAL

The Inter-Agency Peat Task Force was organized in 1979 to coordinate peat/biomass research efforts in Minnesota. Presently it is composed of members from all three divisions of the Department of Energy, Planning and Development (DEPD), the Pollution Control Agency (PCA), the Department of Agriculture (Ag), the Iron Range Resource and Rehabilitation Board (IRRRB), the Department of Natural Resources (DNR), the University of Minnesota (U of MN), the Minnesota Geological Survey, (MGS), the Water Planning Board, the Upper Great Lakes Regional Commission (UGLRC), and the Center for Urban and Regional Affairs (CURA). This proposal has been developed as a cooperative effort, emphasizing input from each department represented, as well as input from the public.

This proposal has also been coordinated with work supported by the U.S. Department of Energy (DOE) through Minnegasco and the Institute of Gas Technology (IGT).

4.1 Resource Development - The DOE/Minnegasco Proposal

Up to now, questions of peat and development for energy resources have centered on the DOE and Minnegasco work on extraction and gasification in a large plant. The issue centered on saying "yes" or "no" to large-scale gasification. This development proposal assumes only minor participation by State agencies and concentrates on the use of peat as the fossil fuel feedstock for a gasification process. The proposal assumes DOE will participate in the construction of a demonstration plant. Discussions about the time schedule with representatives of Minnegasco have indicated two target areas:

1) Late 1982 for the selection of a site for a large-scale gasification plant. Selection of a site would require a commitment of approximately 200,000 acres of peatland.

2) 1986 for acquisition of a Certificate of Need and construction permits.

The major shortcoming of this proposal is its lack of emphasis on resource development and production. This shortcoming could be partially overcome by "paper" studies or evaluations of similar procedures in other parts of the world. However, this data would be suspect because it would not relate specifically to the company's permit application. It should be emphasized that industry's leasing time table does not constrain the State's decision on whether to lease the land. However the time table does point out the need for acquisition of data pertinent to the leasing decision process.

4.2 Resource Development - The Task Force Strategy Considered

Another development strategy leading to the same goal of new energy sources in the same time frame is the one presented in this proposal. It opens up several new areas of information production and therefore augments the DOE/Minnegasco proposal.

The Task Force development strategy considers:

1) New resources - Biomass grown on partially excavated peatlands is evaluated as a feedstock for energy production.

2) Empirical data on the impacts of mining, dewatering and biomass production that will be collected early in the development process.

3) Gasification of biomass/peat combinations that will be tested in coordination with the peat gasification work currently underway at IGT.

4) Minnesota based socio-economic studies that will be completed.

In this strategy, the critical decision on whether or not to select a

site for energy production occurs one year later, in 1983. If the decision is positive, the result is little or no delay in plant construction.

The Task Force member agencies agree that their alternative is better because it:

- provides more data on the decision-makers prior to the time when the critical decision must be made;
- develops more cooperation among State government agencies, private industry, the public and the federal government;
- allows for active participation by the State; and
- provides the opportunity for additional positive outcomes beyond using Minnesota's peat resources for non-renewable energy production.

An evaluation of Minnesota's biomass resource might yield the economic benefits of energy production, plus the environmental benefits of using renewable resources. Therefore, the agencies, as members of the Inter-Agency Peat Task Force, advocate initiation of the development strategy outlined in Sections 5 and 6 of this proposal.

4.3 Initial Discussion Draft

A discussion draft of the Bio-energy Proposal was developed by the Inter-Agency Peat Task Force and was available for public comment on September 15, 1981. The Energy Division coordinated the development and review of this draft. Sections of the proposal were written by each member of the Task Force. The draft proposal became the initial position of the Inter-Agency Peat Task Force.

4.4 Public Awareness and Public Input

The Energy Division assigned a staff person to develop public awareness of the bio-energy research effort in the State. Approximately

two months were spent with reporters from newspapers, radio and T.V. stations in both the Metro and Out-state regions. Reporters were assisted in scheduling interviews with researchers at the University of Minnesota, IRRRB, and State agencies. Feature articles were printed in many newspapers. There were numerous radio and T.V. programs that resulted from the effort. A scrapbook of news articles generated from this effort has been assembled.

Public meetings to review the proposal were held in cities in the peatland region. The meetings were attended by over 180 people. Notice of the meetings was published in advance and people interested in the project could request a copy of the draft proposal. Over 300 copies of the proposal were sent out for these five meetings. The meetings were held in International Falls, Hibbing, Thief River Falls, Aitkin and Bemidji. The program featured a presentation of the proposal by a representative of the Inter-Agency Peat Task Force, a panel discussion that included local community leaders and public comment. The meetings were recorded and used to refine the draft proposal. A detailed summary is included in this document.

4.4 Biomass Energy Survey

A survey of the public was conducted to assess the impact of the public meetings and media effort. The survey focused on awareness of biomass energy options and how research to develop these options should be funded.

Two population samples were chosen. One group included residents of communities that received press or media attention only, and the other group was chosen randomly from the whole state. The state-wide sample reflected the state's distribution of households by area code. The survey was conducted by telephone on weekdays in March during late afternoon and evening hours.

The results of the survey included:

1. A high level of awareness of biomass, crop residues, cattails and willow, alder and aspen as an energy source among both groups of respondents.
   - 83% of the respondents in communities that received press or media attention and 64% of the state-wide sample were aware of these biomass/energy options.
2. Minnesota's natural resources are important as future energy sources.
3. Research should be done to develop these resources for energy, and the State should be involved in funding this research and development.

A detailed summary of the survey is included in this document.

5.0 PROJECT DESCRIPTION

The intent of this project is to provide data pertaining to the use of peatlands, and other wetlands, for energy production. Results of this work, along with previous and current efforts by other groups, will assist State decision-makers in their efforts to plan for Minnesota's future energy needs.

The project is defined by five major task areas: land preparation, biomass production, conversion technology, environmental effects, and systems evaluation. Major effort is directed towards biomass resource production and environmental effects, since these have not received enough attention elsewhere.

5.1 Task I - Land Preparation

This task will begin with the selection of suitable sites for conducting the proposed experiments. Responsibility for site selection will fall on the DNR, DEPD/Energy and the U of MN. The present IRRRB research facilities at Zim would continue to be used for propagation studies, small scale experiments, etc. Since the site at Zim has already been ditched and drained, it will be necessary to select other sites for conducting larger scale tests and tests for previously undisturbed sites.

Land preparation will consist of land clearing, establishment of water control, and some excavation of peat to various depths as required for the biomass production experiments. A fairly substantial involvement on the part of industry is assumed in the task. It is expected that industry will be responsible for most of the excavation, transportation and dewatering work. The peat that is produced as a result of this task would be used in conversion testing in Task III. As a part of the land preparation work, the DNR will be continuously

monitoring the effects on the environment.

Management of this task would fall on the Energy Division and/or a specified consultant. Subtasks would be the responsibility of the Energy Division, the DNR, and U of MN and consultants as specified in the Project Task Lists and Responsibilities section.

5.2 Task II - Biomass Resource Production

A few species of high productivity crops that can be grown on peatlands have been researched over the past three years. They are:

1. Cattail, reed, rush - State of Minnesota/Univeristy of Minnesota/DOE(SERI)
2. Willow and Alder - DOE(SERI)/University of Minnesota
3. Hybrid Aspen - U.S. Department of Agriculture

Several other promising special crop species have not yet been tested.

Preliminary data indicate that special energy crops can produce a renewable feedstock material with cost and conversion characteristics that may be better than the non-renewable peat on which they would be grown. However, no harvesting, processing or transportation tests have been conducted. From a long-term perspective, production of an economically competitive energy source on peatlands appears more desirable than peat mining.

The biomass energy option should be evaluated before allowing a peat mining technology that could harm the soil's biomass production potential. Also, preliminary information suggests that some peat removal may be desirable to reduce costs and facilitate the establishment of stands of biomass plants. It is the purpose of this task to:

- generate productivity data for selected biomass species;
- conduct harvesting and transportation tests;
- determine what degree of peat removal is optimal for

energy crop production;

- determine the effect of peat stratigraphy on biomass production.

Small scale propagation and productivity tests will also be conducted on previously untested species. Previously researched species would be grown on one-half to one acre plots in unexcavated peat areas and in peat areas excavated to various depths, (i.e. those areas provided by Task I testing). Various nutrient applications, water levels, and preparation methods will be tested. Harvesting, drying, and transportation tests will be conducted with equipment purchased for the current wetland bio-energy crops project. Any additional equipment that is needed will be either leased or purchased.

The DNR will monitor biomass production environmental effects as described in Task IV.

Task management will be the responsibility of the Bio-Energy Coordinating Office at the University of Minnesota. The Energy Division and DNR will be responsible for some of the work on various parts of this task.

5.3 Task III - Biomass and Biomass/Peat Conversion

Peat gasification tests are now being conducted at the Institute of Gas Technology (IGT) under DOE sponsorship. Preliminary energy crop conversion tests using digestive processes also have been conducted. Results of this work can be incorporated into a program making use of the IRRRB gasifier at Zim. Peat and biomass gathered during previous work will be used as a feedstock for this test. Experimental work in this area would be carried out under the direction of the IRRRB, the U of MN, the Energy Division, and/or consultants as needed.

Use of peat and biomass as a solid fuel seems to hold the best

prospects for the near future. The Inter-Agency Peat Task Force is presently developing a test program, in cooperation with the Virginia Public Utility, to determine the feasibility of peat as a supplement to coal in medium size boilers. It may be possible to expand the scope of this program to include biomass fuels.

Data collected as a result of proposed and existing investigations will be used to make an economic evaluation of each of the basic technologies. Evaluations will be based on current technology and will reflect present possibilities or areas for further work. This work would be done by the Energy Division with assistance from required consultants.

5.4 Task IV - Environmental Effects Monitoring

Data on current environmental conditions in the peatlands have been gathered over the past four years by the Department of Natural Resources. No empirical data exists on the environmental effects of biomass production in the State. Based on technologies and methods selected in Tasks I and II, the DNR and the PCA will design a plan for monitoring both peat excavation and biomass production to determine the environmental effects of producing each energy resource. The DNR will then be responsible for executing the planned work. Peatland water quality, water use and run-off, as well as any effects on groundwater, vegetation, wildlife, and air emissions will be documented. The end product will be a comprehensive data base on the environmental effects of peatland biomass production, which would be used in energy-related peatland leasing decisions. Estimates of air and water emissions, water use, and solid waste generation for various energy conversion technologies will be made by researchers as part of their work in Task III.

5.5 Task V - System Evaluation

At present, one peatland energy production system (large-scale, thermal-chemical peat gasification) is being analyzed under a DOE grant. There has been interest expressed in medium-scale direct burning of both wet and dry peat for electric production, smaller-scale direct combustion of peat and/or biomass and biological conversion of peat and/or biomass. However, funding has not been available to analyze these processes.

The organization(s) selected to perform this task will analyze data obtained from Tasks I, II, III, and IV to determine the economics of various energy production systems at several sizes (i.e. large, medium, or small-scale). This information can be used to evaluate development options. In addition, a portion of this task's effort will be devoted to assessing the socio-economic effects of peatland energy development. This task would be conducted by the Department of Energy, Planning and Development and an as yet unspecified consultant.

5.6 Project Management

Overall project management will be the responsibility of the Energy Division. It will prepare a detailed work plan showing designated tasks. It will also exercise budget control over independent subcontractors. The Inter-Agency Peat Task Force will monitor the project, and provide advice and assistance to the project manager.

The University of Minnesota's Bio-Energy Coordinating Office will manage the biomass production portions of the project. It will coordinate other University departments in their work on chemical and economic analysis, agricultural methods, plant propagation, and growth and productivity. Work done at the University will fit into the overall project management system.

The Department of Natural Resources' Minerals Division will manage collection of environmental data. It will work with the Pollution Control Agency to develop a monitoring plan which will yield the data needed in subsequent leasing decisions. It will probably hire, with the concurrence of the Task Force, a consultant to perform actual field work.

An Environmental Advisory Committee will be appointed to review environmental data and to comment on its meaning. It will review the monitoring program designed by the DNR and the PCA and will suggest possible modifications during the course of the project. Committee members will be selected by the project manager to represent State agencies, contractors, environmental groups and industry.

The Department of Energy, Planning and Development will manage the socio-economic effect analysis performed in this project. Work will be done by the Planning Division of the Department. The Department will likely hire a contractor to perform the analysis.

The Energy Division will oversee the peat excavation and systems evaluation work also. Performance of the required work would be done by personnel from the U of MN, the DEPD and required consultants.

Consultants will consist of as yet unspecified persons needed to perform specific functions. They may be drawn from any of a number of sources, including the University of Minnesota, State agencies, the private sector, etc.

6.0 PROJECT TASK LIST AND RESPONSIBILITIES

Task I. Land Preparation (Engineering Consultant)

A. Site Selection (DNR/DEPD/U of M)

B. Assess Potential Methods and Equipment (DEPD/Peat Consultant)

C. Contact, Arrange and Manage Selected Systems Testing Schedule (Engineering Consultant)

D. Initial Land Preparation (Engineering Consultant)

E. Excavation Tests/Task II Preparation (Industry/Engineering Consultant)

1. hydraulic method
2. mechanical removal method
    a. drained bog
    b. undrained bog
3. other technology/European technology

F. Transportation System Tests (Industry/Engineering Consultant)

1. pipeline slurry
2. conveyor belts
3. mechanical bog transporter
4. transporter/railway
5. other

G. Dewatering Equipment Tests (Industry/Engineering Consultant)

1. slurry dewater methods
    a. filter press
    b. centrifuge

b. peat removal to various depths - mechanical preparation tests on drained and undrained areas

2. Planting and cultural methods

a. establishment with seeds

1) water level tests

2) time of planting tests

3) mixed planting tests

b. special herbaceous crop tests

1) spacing tests

2) time of planting tests

3) water level tests

4) fertilizer response

c. competition control tests

d. insect and pathogen control tests

C. Establishment of Large Scale Plots (U of M/ Engineering Consultant)

1. Procure sufficient planting material

2. Plant test plots with four available species

a. willow

b. cattail

c. aspen

d. crop identified under II-A

e. combinations

3. Monitor Task II.C.2 results

4. Plant additional plots as determined from Task II.B

5. Conduct coppicing studies on woody crops

c. drying bed

d. other

2. Undrained peat dewater methods

(same as I.G.1)

3. Drained peat dewater methods

(same as I.G.1 except add):

e. in-situ drying techniques

H. Economic Evaluation of Systems (Engineering Consultant/DEPD)

Task II. Biomass Resource Production Testing (U of M)

A. Stand Establishment and Management (U of M)

1. Screening potential biomass crops

a. cattail (Typha)

b. willow

c. aspen (Hybrid)

d. alder

e. reed (Phragmites)

f. sedges (Carex)

g. reed canary grass

h. other (two unspecified species)

2. Propagation studies

a. micropropagation (tissue culture)

b. macropropagation (cuttings/grafting)

B. Field Trial Plots (small scale) (U of M)

1. Site preparation

a. no peat removal

1) mechanical preparation tests

2) chemical tests

3) combination tests

D. Biomass Harvest and Processing Methods (U of M/DEPD)

1. Harvest Equipment Tests

a. wetland harvesting development/test

b. test equipment for woody crop harvest

c. other mechanical removal method tests

d. hydraulic harvest test

2. Transportation System Tests (Engineering Consultant/ U of M) (same as I-F)

3. Biomass Drying Tests (U of M/Engineering Consultant)

a. air dry in-situ

b. baled air-dry

c. filter press

d. other

e. combination

4. Biomass Scheduling Economic Assessment (U of M/ Economic Consultant)

a. single season harvest/storage

b. multi-season harvest/storage

c. year-round harvest

5. Economic Evaluation of Systems (U of M/DEPD/ Economic Consultant)

Task III. Biomass and Biomass/Peat Converstion Testing (U of M/ IRRRB/Engineering Consultant/DEPD)

A. Lab-scale Gasification (U of M)

1. thermobalance tests

B. Small Scale Tests (U of M/IRRRB)

1. hydrogasification

2. fluidized bed gasification

C. Gasification Process Economics (U of M/DEPD/Consultant)

D. Liquification Process Economics (U of M/DEPD/Consultant)

E. Solid Fuel Process Economics (Consultant/DEPD)

Task IV. Environmental Effects Monitoring (DNR)

A. Water Qualify Monitoring (DNR)

1. Biomass field outlet
2. Peat mining pond
3. Peat mining area outlet
4. Downstream sites

B. Water Quantity Monitoring (DNR)

1. Surface water volumes in biomass fields
2. Ground water volumes in biomass fields
3. Water consumption/run-off

C. Vegetation Effects Adjacent to Biomass Fields (DNR)

D. Wildlife Effects and Population (DNR)

E. Air Emissions at Resource Site (PCA/DNR)

F. Possible Air Emissions from Various Conversion Technologies (PCA)

G. Solid Waste Generation from Various Conversion Technologies (PCA)

Task V. Energy Production and Conversion System Evaluation (DEPD)

A. System Economic Analysis (DEPD/Economic Consultant)

1. Resource production and conversion system (DEPD/Economic Consultant)

a. gaseous fuel production

b. liquid fuel production

c. solid fuel production

2. State economic impact assessment (DEPD)

B. Social Impacts of Energy Development (DEPD/U of M)

7.0 PROPOSED BUDGET BY TASK (in thousands of dollars)

	TASK MANAGER					
	Equip. Subcon-tractor	U of MN Bio-Energy	DNR	DEPD	Con-sultant	Total
TASK I Land Preparation						
A. Site Selection	-0-	-0-	-0-	-0-	-0-	-0-
B. Methods Assessment	-0-	-0-	-0-	10	40*	50
C. Management of Tests	-0-	-0-	-0-	10	40*	50
D. Land Preparation	175	-0-	-0-	-0-	-0-	175
E. Excavation Tests	-0-	-0-	-0-	-0-	-0-	-0-
F. Transportation Tests	-0-	-0-	-0-	-0-	-0-	-0-
G. Dewatering Tests	-0-	-0-	-0-	-0-	-0-	-0-
H. Economic Evaluation	-0-	-0-	-0-	5	15	20
TASK II Biomass Resource Production						
A. Stand Estb. and Management	-0-	95	-0-	5	-0-	100
B. Field Trial Plots	20	125	-0-	5	-0-	150
C. Large Scale Plots	50	190	-0-	10	-0-	250
D. Harvest/Process Methods	-0-	230	-0-	20	-0-	250

*Peat Mining Consultant

	TASK MANAGER					
	Equip. Subcon-tractor	U of MN Bio-Energy	DNR	DEPD	Con-sultant	Total
TASK III Biomass/Peat Conversion						
A. Lab-Scale Gasification	-0-	50	-0-	-0-	-0-	50
B. Process Development Gasification	-0-	100	-0-	-0-	-0-	100
C. Gasification Economics	-0-	-0-	-0-	5	10**	15
D. Liquification Economics	-0-	-0-	-0-	5	10**	15
E. Solid Fuel Economics	-0-	-0-	-0-	5	20**	25
TASK IV Environmental Effects						
A. Water Quality	-0-	-0-	105	-0-	-0-	105
B. Water Quantity	-0-	-0-	69	-0-	-0-	69
C. Vegetation Changes	-0-	-0-	20	-0-	-0-	20
D. Wildlife Effects	-0-	-0-	18	-0-	-0-	18
E. Resource Air Emissions	-0-	-0-	50***	-0-	-0-	50
F. Conversion Air Emissions	-0-	-0-	60***	-0-	5**	65
G. Solid Waste Generation	-0-	-0-	18***	-0-	5**	23

**Economic Consultant

***These funds may go directly to PCA

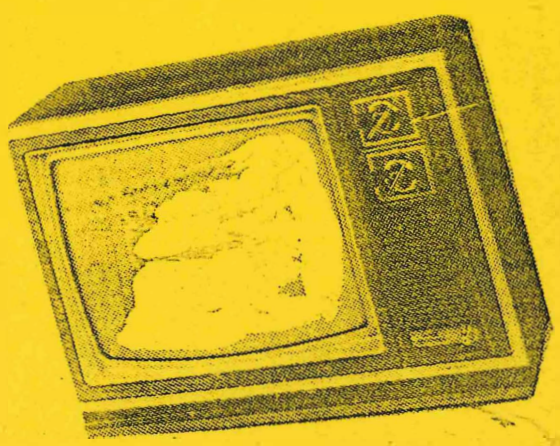
		TASK MANAGER					
		Equip. Subcon-tractor	U of MN Bio-Energy	DNR	DEPD	Con-sultant	Total
TASK V	System Evaluation						
	A. Economic Analysis	-0-	-0-	-0-	20	30**	50
	B. Social Impacts	-0-	-0-	-0-	10	10**	20
	TOTALS BY TASK						
TASK I	Land Preparation	175	-0-	-0-	25	95*	295
TASK II	Biomass Resource Production	70	640	-0-	40	-0-	750
TASK III	Biomass/Peat Conversion	-0-	150	-0-	15	40**	205
TASK IV	Environmental Effects	-0-	-0-	340	-0-	10**	350
TASK V	System Evaluation	-0-	-0-	-0-	30	40**	70
	TOTAL	245	790	340	110	95* 90**	1670
	Project Management	-0-	-0-	30	60	-0-	90
							1760

*Peat Mining Consultant

**Economic Consultant

II.

MEDIA COVERAGE: NEWSPAPER/RADIO/TV



Near the field of willows, still more cattails are growing. Here, the researchers are trying to determine the best depth of peat in which cattails will grow. Three plots are growing. So far, the scientists have found that weeds will thrive if the peat is not excavated.

As we rode, I watched Pratt's expressive face and thought, "These are not merely academicians. There's no apparent apathy. How stimulating it is to mingle for awhile in the world of these 'charged-up' specialists. They believe in what they're doing and invest their whole selves into the success of the project."

THIEF RIVER FALLS TIMES PAGE 11
Wednesday, Oct. 14, 1981 Thief River Falls, Minn.

The Country Echo

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PEAT, WOOD CHIPS USED TO PRODUCE ELECTRICITY - BY: RODERICK KIELY

THE HIBBING DAILY JOURNAL

As non-renewable energy resources are being depleted in the world, alternative renewable energy resources are being studied.

Experimentation with peat and wood chip burning is being conducted at the WVF (Wilderness Valley Farm).

THEY'RE LOOKING AT CATTAILS FOR ENERGY SOURCE - BY: JIM DAWSON

THE MINNEAPOLIS STAR, SEPT. 18, 1981

In a muddy, mosquito-infested pond a few hundred yards from a debris-filled lot on the University of Minnesota's St. Paul campus, three researchers stood knee-deep in what may be Minnesota's energy future.

They struggled aboard a balloon tired $30,000 "floating research platform," kicked on a winch and watched as a meter measured the slow progress of a submerged disc blade being pulled through the muck.

FARMING FOR ENERGY: WILL CATTAILS SUPPLY MINNESOTA'S FUTURE ENERGY NEEDS? - BY: LOUIS HOGLUND

THE PIONEER (BEMIDJI), SEPT. 2, 1981

There is a vision of a political cartoon running through the minds of some at the Minnesota energy agency.

The scenario painted looks something like this: imagine a Minnesota farmer with bib overalls and a Dekalb cap standing next to an Arab with flowing robes. The Arab is standing next to a gas pump holding the nozzle in his hand. The farmer says to the Arabina (sic), "No thanks, we'll grow our own."

It's an interesting concept -- growing energy. Though it is relatively new, it is not science fiction.

CATTAILS STUDIED AS ALTERNATE FUEL SOURCE IN STATE - BY: PAUL WILLIAMS

MESABI DAILY NEWS, AUG. 30, 1981

Minnesota may eventually be energy self-sufficient if any of the recent ventures into the energy field bear fruit.

An addition to such energy developments as peat gasification, gasohol from poplar trees and various forms of solar energy, the use of cattails and other forms of aquatic plants has been suggested to help fill the state's energy needs.

The recent energy crunch has spurred efforts to come up with alternate fuel sources. Many energy experts believe renewable sources offer the best long run answer to replacing dwindling supplies of petroleum. With Minnesota's abundance of wetlands, cattails are a natural source. ...

Cattails appear to be promising because of their rapid growth and ease of cultivation. Cattails grow best on boggy land which would be difficult to use for other crops without a large investment in drainage systems and land preparation. Using the plant for energy would not require taking large amounts of land out of food production as would the use of corn for gasohol production.

STATE AGENCY STUDIES ALTERNATIVE ENERGY SOURCES - BY: MARVIN LUNDIN

THIEF RIVER FALLS TIMES, AUG. 24, 1981

Biomass appears to provide the best energy source alternative to gas, petroleum and coal, according to a top official of the Minnesota energy agency, and northwestern Minnesota may be at the doorstop to the best source of biomass under study today.

UNIVERSITY ZEROES IN ON BIOMASS ENERGY - BY: MARVIN LUNDIN

THIEF RIVER FALLS TIMES, AUG. 26, 1981

Not many years ago, a major oil company promoting its search for new reserves used the slogan: "A nation that runs on oil can't afford to run out!"

Oil, in whatever quantities it exists, is a limited resource. It was formed over eons of time and once used is gone forever. This eventuality -- and perhaps more importantly the impact of the high costs associated with constant supply -- are leading forward-thinking researchers to study other means of energy production.

CATTAIL PRODUCTION STUDY NECESSARY FOR SUCCESS - BY: MARVIN LUNDIN

THIEF RIVER FALLS TIMES, AUG. 31, 1981

To those northern Minnesotans who are accustomed to seeing cattails appear anywhere moisture is present -- from a low spot in a grain field to a depression in a drainage ditch -- the idea that scientists are trying to learn how to grow them may seem a little ridiculous.

But as the words of a once popular song indicate, it ain't necessarily so.

BIOMASS VERSATILITY IS KEY TO FUTURE DEMAND - BY: MARVIN LUNDIN

THIEF RIVER FALLS TIMES, SEPT. 2, 1981

One of the nation's noted scientists is impressed with the versatility of biomass conversion and feels that it is deserving of much more funding and study. ...

Several major routes can be followed in utilization of biomass, including extracting chemicals for use in industry instead of producing energy. ...

But it is entirely possible -- even probable -- that energy and chemical demands and costs will permit the utilization of prolific plant life which our area can provide. When that time comes, the answers to many of the questions should be at hand. That's what forward-looking research is all about.

LOWLY CATTAILS MAY END UP FUEL FOR VEHICLES, FURNACES - BY: JIM SLOAN

THE BRAINERD DAILY DISPATCH, SEPT. 27, 1981

Cattails. Kids use them as spears or make-believe swords. They've been made into coffin liners and, in World War II, life jackets.

In Sweden, a relative of the cattail has been used for 50 years to thatch the roofs of homes.

Now, University of Minnesota scientists claim, the lowly cattail may end up in the gas tank of your car, or fueling the furnace of your home.

COULD THIS WEED BE THE CASH CROP OF THE 1990'S - BY: ROB HOTAKAINEN

DETROIT LAKES TRIBUNE, SEPT. 24, 1981

Cattails just might be the cash crop of the 1990s in Minnesota.

That's what scientists at the University of Minnesota in St. Paul, who are conducting an exhaustive research project, are hoping. ...

The researchers, working under the direction of botanist Douglas C. Pratt, are out to prove that cattails can supply a significant portion of Minnesota's energy needs in the coming years.

Cattails are a natural energy source for Minnesota, says Pratt. They have grown in abundance on the state's wetlands for centuries without the benefit of fertilizers, insecticides, or cultivation. Measurements show that their long, narrow leaves expose an exceptionally large green area to the light — twice as much, for example, as corn.

AITKIN: NEIGHBORS WATCH FARMER WITH 'GENUINE INTEREST'

DETROIT LAKES TRIBUNE, SEPT. 24, 1981

James Godward is a rice farmer. He claims that he was the first farmer in the state to receive a commercial rice permit.

... and he always had problems with the surrounding cattails. He spent a lot of time with his son Tom trying to get rid of them because they would mix with the rice and shade them out.

Now Godward is espousing the "if you can't beat 'em, join 'em" philosophy. He's growing cattails.

Godward read an article about the possibility of cattail energy in the Minneapolis Tribune four or five years ago. "It struck my eye immediately," he said. "Then I heard on the radio that money had been appropriated to the University of Minnesota for this biomass study. So I called up Ron Visness (assistant director) at the energy agency and told him I'd be willing to let them use some of my land for their experiments."

ENERGY OF THE FUTURE MAY COME FROM SWAMPS - BY: CRAIG NAGEL

THE COUNTRY ECHO (CASS & CROW WING COUNTY LAKES), OCT. 22, 1981

In recent years, the subject of energy has come to resemble the weather -- everybody seems to be talking about it, but nobody does much about it.

When the Arab oil embargo occurred in 1973, most Americans were caught unprepared. We had come to regard plentiful--and cheap--supplies of oil as something of a natural right, something as common as air to breathe or water to drink.

Since then, we've found that cheap and bountiful oil is not necessarily part of our birthright. And just recently we have begun to see that oil and its less fluid sister, coal, can do a great deal of damage to the air and water we must have in order to continue living.

We have come, in a very few years, to find ourselves in something of a bind. With fossil fuel supplies dwindling and with the safety of nuclear energy in grave doubt, the future looks much dimmer than it did a decade ago.

For Minnesotans, the future might seem especially dismal. Ours is an energy-poor state. We pump no oil. We mine no coal. Our winters are long and bitter.

LACK OF RESOURCE BASE DISADVANTAGE TO BIOMASS - BY: CRAIG NAGEL

THE DAILY JOURNAL (INT'L FALLS), OCT. 29, 1981

The beauty of biomass is that it can be grown and harvested and regrown, just like a conventional plant crop. And when you consider that Minnesota has extensive areas of peatbogs and other wetlands not currently useable for productive purposes, biomass takes on an added appeal.

"The main disadvantage to growing crops for energy is the lack of resource base," says Dr. Rouse Farnham, soil scientist and Minnesota's principal investigator of woody biomass. "In most states, land is too expensive to make biomass production cost-effective. But Minnesota has more than 6 million acres of peatlands and another 10 million acres of wet mineral soil lands, a lot of which could be put to work producing biomass.

BOG-TYPE PLANTS BEING STUDIED FOR ENERGY POTENTIAL - BY: JOEL SOTTRUP

PRINCETON UNION-EAGLE, SEPT. 24, 1981

...Geologists are still traversing the Iron Range, looking for more ore, but recently scientists have been researching the possibility of using the Range as a place to grow an energy source.

If current studies produce favorable conclusions, the vast wet bogs in northern Minnesota could some day have fields of cattails and other plants being grown to produce synthetic fuels for helping energy-poor Minnesota.

Whoever could have thought years ago, or even today, that a table centerpiece plant like the cattails could become so important as to be a focus of energy research?

FUEL FOR THE FUTURE TOMORROW'S ENERGY MAY BE HOME GROWN - BY: SHARON NOVOTN

DULUTH NEWS-TRIBUNE/HERALD, OCT. 17, 1981

ZIM--If OPEC nations knew how Rouse Farnham's garden grows, they just might boost oil prices while there's still time.

Because, by the year 2000, Farnham hopes Minnesota won't have to go to the world's oil wheels as often for energy. He is convinced fuels can be homegrown.

That's good news in a state which has no traditional coal or oil resources within its boundaries and spends about $12 to $16 million a day or $6.5 billion a year on energy. About $4.5 billion of that annual total leaves the state, ...

PROBING CATTAILS FOR TOMORROW'S ENERGY - BY: ELAYNE MAKI

THE WESTERN ITASCA REVIEW (DEER RIVER), SEPT. 1, 1981

Scientists at the University of Minnesota are studying the economic feasibility of planting and harvesting renewable energy plants. Plants grow quickly and are natural solar collectors. Some more efficient than others. Presently, the team of researchers is gathering and coordinating biological, geological and technological information on bio-mass plants with a view toward converting the sun's energy, synthesized in the plant matter, into liquid fuels, or methane gas.

INDEX OF VIDEOCASSETTE/CASSETTE TAPES AVAILABLE

Videocassette

Biomass Energy - 25 minutes
KMSP-TV - 4 parts
WDIO-TV - 2 parts
WDLH-TV - 2 parts
KMSP-TV - Inn Report (New York)

Cattails - WDIO-TV

Cattail Alternative Energy - produced by KANE-TV

The Cattail Connection - TV Newscenter 11 Series

The Cattail Project In Minnesota, Newsman Richard Connell Intervies Dr. Pratt - produced by KCMT-TV/Alexandria

Cassette

Dr. Rouse Fahrnam(sic) - KKAQ Radio Interview

Rouse Farnham on Peat Development in Minnesota - Minnesota Public Radio

III.

PUBLIC INPUT MEETINGS

Please join us for a meeting
In Chisholm:

Thursday
December 10, 1981
Iron Range
Interpretative Center
7:00 p.m.

Co-sponsored by Hibbing Chamber of Commerce

Please join us for a meeting in Thief River Falls.

Monday, Dec. 7, 1981
Northland Community College
Amphi-Theatre Classroom A-16
7:00 P.M.

Co-sponsored by Northland Community College

During December, the Energy Division of the Minnesota Department of Energy, Planning and Development took the Inter-Agency Peat Task Force Bio-Energy Research Proposal to northern Minnesota for community input.

The purpose of the proposal is to coordinate the work being done in the state on bio-energy, and to reach the goals of producing biomass materials on a reasonable scale, testing those materials for energy conversion, and measuring the environmental impacts of the production system. Minnesota production and conversion costs for these resources can thus be meaningfully estimated, prior to any peatland leasing decision that will lead to significant peatland energy production.

The communities visited were Aitkin, Bemidji, Hibbing, International Falls and Thief River Falls. Even though the meetings were planned to cover the same topics, they varied considerably. To a large extent the audiences determined the items discussed, and their interests were quite different. In Aitkin, where farming on peat is practiced, the questions related to bio-energy as a farming supplement. In International Falls, which was a Koochiching county-wide meeting, the audience was more interested in large-scale development and jobs. The groups in Hibbing and Bemidji, stayed closer to the proposal itself, and the very small group in Thief River Falls was mainly interested in environmental matters.

Other areas of discussion included the Minnegasco proposal to build a large commercial-scale peat gasification plant, the

economic feasibility of bio-energy, who should be involved in the funding of projects, and the desire to get something on-line and producing soon.

This report contains some of the comments of the people attending the meetings. The Energy Division has taken many of these into account in its modification of the Bio-Energy Research Proposal. However, a proposal is not able to reflect the feelings and beliefs of those attending. Only their direct comments can convey their attitudes. The following comments are organized around five key issue areas:

- the local economy and jobs
- calls to action
- the economic feasibility of bio-energy
- environmental concerns
- who should manage bio-energy development in the state

COMMENTS ON THE LOCAL ECONOMY, JOBS AND THE DEVELOPMENT PROPOSALS

"I've seen a lot of people come to this life we have here because they consider it the good life. I'm seeing them leave because there is no life here without means of support. I think we've reached a point now where we're going to have to make a change in our way of life in order to preserve what we have here. And maybe the change lies out in those bogs that we've looked at for so many years. I used to feel that we should go in there and pick the blueberries and enjoy what little life there is in the bog that was visible besides the mosquitoes and the flies and the gnats. Well, from all that we hear about the bogs, whether it be to grow biomass or to harvest the peat, the bogs now might be our second way of life in this county." (International Falls)

"The fuel dollars are obviously leaving the State of Minnesota. I can attest to that. I'm spending megadollars-megabucks, buying coal from Montana and Wyoming..... I've heard the statement made that

perhaps Minnesota will be the little Saudi Arabia of the United States. Well I don't know if that's true or not; I don't know if I'm going to be wearing a turban instead of running a turbine in my power plant in the near future, but we do have vast resources of peat as have been shown in the slide presentation." (Hibbing)

"I just want to get back again to the comment about whether the State should be concerned. But when you're an energy dependent state, and the more that the energy costs you, the more you're going to be an economically distressed state if you don't start looking into trying to overcome some of these things." (Hibbing)

"We have to consider the long range versus the short range economics. The short range economical solution is the consumption of the peat--mine it, burn it; mine it, gasify it. However I feel that the long range solution is the biomass production. Now certainly there are going to be lands that are better suited to mining and consumption of the peat, and there are going to be lands that are better suited to the biomass production. It's important that studies like this are made in order to determine which lands can be put to which uses for the best resource utilization for the State of Minnesota." (Hibbing)

"With the Minnegasco project there's 400 on-going jobs and that's 400 more than we've got now." (International Falls)

"We have an industry that has come out and said that they're willing to put a billion dollar investment in this county. Our taxation now is $58 million, so if you can visual $50 million and what it would do, you could see what a boon it would be to this county. And I think we could use 1,200 jobs at this time." (International Falls)

"It seems to me you'd want to concentrate on smaller operations for the small farmer who would want to use it as a farming supplement." (Bemidji)

"If we can get more energy out of our peatlands using many alternatives, Minnesota should do that. I think it's stupid not to!... I think a combination of the two processes makes a lot more sense than just using extractive process. Why should we go ahead and all of a sudden figure out we've got to have jobs for 1,200 people, utilize the peat and then figure out that we could have had jobs a lot longer and got a lot more energy out of our peatbog than if we just went in and took out the peat in the first place." (International Falls)

"There's a lot of peat and I would think we should go ahead and get Minnegasco going. And if there needs to be more information gathered on cattails that should be gathered. There ought to be more things done. Clearly the peat is there and utilizing even a few hundred acres of it for anything ought to be useful.... I guess I don't know why the gasification process (Minnegasco's proposal) and the growing of high protein grasses, cattails, or whatever can't be a compatible process?" (International Falls)

CALLS FOR ACTION

"I keep hearing about this research. I sat at that Peat Committee for six years and all they do as far as I can see is research. You can wade on the material they put out, you can't read it, it's too much! Mr. Sundberg was talking about this peat being young coal. You yourself, said it took 3 or 5 or 7 thousand years to grow. Well, we'll have a coal product before those guys at the State are done." (International Falls)

"I would think that from what I've heard here tonight, we might just as well all come back in ten years and hear the results of the biomass study because there's really nothing more at this point to be done and I think that's a shame." (International Falls)

"We just hope something will get going. Get done with these studies and hope that something starts happening around here." (International Falls)

"I think most of us think there ought to be less research and more action." (International Falls)

"Right!" (International Falls)

"Absolutely!" (International Falls)

"It would appear to me that we're not any closer to resolving our energy problems now than we were 30 or 40 or 50 years ago. All I've ever seen is studies upon studies upon studies. If I'm in the business to sell my so called services and I'm to come up with a study so that the end result is an energy product, that's what I'd do. But you, you spend billions of dollars on studies and you get lots of studies, but you don't produce one Btu out of the whole damn thing. I say that it's time you start keying in on things. You always say, well the bottom line is dollars. Granted that's so, but I think we're going to have to rely on our instincts." (Hibbing)

CONCERNS ABOUT THE ECONOMIC FEASIBILITY OF BIO-ENERGY

"The whole works is a matter of economics. The time I don't think has arrived for the economics of peat to be utilized from the point of view of a direct fuel. In fact, I think it would be a mistake to be mining peat and trying to burn it in competition with coal for the simple reason that you would be destroying a resource that we have in this state that could be utilized as a renewable biomass. Actually I don't think we're at the stage today where biomass fuels, except in special cases are yet competitive. But I think the thing that should be done now, is to go through the research and have the answers available so that when the time comes that the economics are right you'll be able to move into it." (Hibbing)

"Will biomass crops be a practical way to provide some of Minnesota's energy needs? Obviously the economics of the situation must be clearly supportative. If a subsidy in any form from public sources is required, the effort should be aborted and alternatives evaluated." (Thief River Falls)

"I previously made the comment that I wasn't optimistic about the mining of peat as a fuel. There's no question that you can do it, but it's economics--that's the whole story. And if our peat was even close to being economical as a fuel we would have people pursuing it very diligently. Economically, I don't think it's in the cards for several years now." (Hibbing)

"One of the reasons why these things aren't done, is because it's cheaper to use natural gas, wood, electricity, and hydro-power. What it comes down to, it seems to me, is how much energy do you have to expend to get the energy back? And can you do it? Nobody in their right mind can spend more money than they have to get energy." (International Falls)

"At this point you've talked about producing the energy, but you haven't got anyone using it. The problem is threefold: 1) you have to overcome the public's unawareness of the fuel, 2) the cost of converting existing systems to biomass in the poor economic climate and 3) find the market place." (Hibbing)

"I'd like to be sure that they don't get the cart ahead of the horse. By that I'm not much interested in environmental studies, impact statements, permits, pollution control, royalties, competitive biding and so forth. I think the money should be spent on finding out if there is an economical use for our peatlands. I think that's where the emphasis should be put to start with. If we can establish that there is an economic possibility, then

we can explore these other things. I'm not overly optimistic about the development of peat itself as an energy source. Our peat is mostly in bogs, and I'm afraid you're going to spend (more) Btu's (extracting it) to use it as a heat material substitute than Btu's that are in it. But I'm enthusiastic about the biomass thing and I think that it should be studied quite carefully." (Hibbing)

"Maybe I didn't make myself clear on that, but I think the purpose of this plan as I see it and the reason for the public hearing it seems to me, is to work out a way in which Minnesotans can get the sorts of energy as cheap as possible from within the State so that we can cut down on our reliance on the bulk of the energy coming from the outside. And it looks good that we can take a billion dollars from Minnegasco to produce a plant, but my question would be are we going to have a gas that's going to be as cheap or cheaper than what we could buy from some other source? And then on top of that, how much energy do we have to expend for mining, drying, and transporting the stuff? That's the question and I don't see any of that stuff addressed here." (International Falls)

ENVIRONMENTAL CONCERNS

"And have you stopped to consider the environmental impacts of removing large deposits of peat. Right now when you consider the habitat that it supports and consider the fact that they are natural filtration beds for water supply and have you stopped to consider the fact that you'd have severe run-off in areas if you were to start stripping the large peatbogs." (Hibbing)

"The question that concerns me is if we have peat mining, what will we have when we're done? I'm talking preimarily in terms of using peat. Will it move our water tables, will we lose our wildlife and our eco-system that we have here now? It must be that what we have here now is here because all the different systems work together. If we do this on a big scale we'll be disrupting an awful big part of our environment. How do we know that in the future we wouldn't have been better off with the water resource than with the energy resource. We may be better off to using our peat resources to store water." International Falls)

"How will biomass crops affect the area hydrology with regards to water quality, water flow patterns and water flow volume? Water quality is critical as the loss of a fishery such as the Red Lake fishery would be unacceptable due to the million dollar a year income derived therefrom." (Thief River Falls)

"Will harvesting the biomass crop result in degradation of air quality? For example it may be necessary to burn off waste products, or airborne dust may be a problem due to transportation of the material to processing facilities." (Thief River Falls)

"If you're going to flood thousands and thousands of acres of peatlands to harvest a product off it, the lakes and rivers have got to stop somewhere along the line. There's just so much water whether you take it out of the ground or whatever you do with it. It's got to affect lakes and rivers, (developing peatlands into a biomass product), it's got to!" (Aitkin)

"...(countries) that use the peat, when that peat is taken off, and it's regulated, then that land is reclaimed. They grow grasses on it. Did you know that Roseau County produces more bluegrass per acre than any other place in the U.S. of America. The bluegrass is grown on peat. So the peat can be reclaimed. The land can be used again. It doesn't necessarily have to be a wasteland after we remove the peat." (International Falls)

"I just have a comment. I was at the Peat Congress also and I saw one presentation where in Michigan they had about 400 acres of peat where they had taken the top off about twenty years ago. There's nothing growing on it now, just sporatic weeds. So I wouldn't agree with your comment that you can always reclaim a bog. I think the acidity would be extremely high. You might want to dump sludge in it, that would help it become more fertile, but I don't think you can always grow something on it." (International Falls)

"This leads us to the second point, the ecology. I disfavor the large scale mining of the peat and the gasification of that. I feel that we'd be better positioned if funds were spent to examine the gasification of the biomass rather than the peat. I also feel that capital expenditures to determine the feasibility of peat comsumption in either the gasification process of the direct combustion such as in the power plant in Virginia are really a short run solution. These dollars could be better spent in developing the biomass uses. It's important that the State protect, and I'll use the term manager, the resource. I feel that the federal government has looked upon the State of Minnesota as having a resource - peat, and then plowed dollars into the gasification technology. The State should be aiming it's resources towards the management of the peatlands rather than consumption and utilization. Basically you can probably tell if you had an opportunity to read the proposal here, that I agree with the Peat Task Force's second alternative." (Hibbing)

WHO SHOULD BE INVOLVED AND HOW?

"Well on Question No. 1 (Should the State support development of biomass (special energy crops) for energy purposes?), I'd strongly recommend it because we're an energy dependent state. The state is going to have to be involved." (Hibbing)

"I think the total state is going to have to be involved, not just St. Paul. If you're going to produce and use the things within a certain, given area, that area of course should be involved." (Hibbing)

"That's right more local people should be involved and local planning units within the counties so that they know what's coming up, same thing with local business leaders." (Hibbing)

"I know one of the things the county is interested in, and that I would like to have an answer on in terms of your proposal, is what is the involvement of private industry? One of the things that intrigues me about the Minnegasco proposal is that they use private industry and I notice that in looking through your proposal, there isn't one mention of working with private industry." (International Falls)

"There's not a provision for community participation." (Hibbing)

"If you're going to move into a area like we have here, I think that the community should be involved. I don't see any provision in here involving any - local community people, chamber of commerce, or local leaders. If you go into any development of this, you'll need these people because there are things that have to be done without which your project won't be done and that stuff is done by the taxpaying public. I think it should be involved." (Hibbing)

"I'm in agreement with the thought that the State should be expanding the energy resources but definitely private industry should be taking over and developing it - with the State's help certainly." (Hibbing)

"I understand that with the State of the economy the way it is, the State of Minnesota economics, it doesn't really have enough money to run now, I think they're going to have trouble funding most of the aspects of this proposal. I think you're going to have to carry these things over to the private sector as much as possible." (Bemidji)

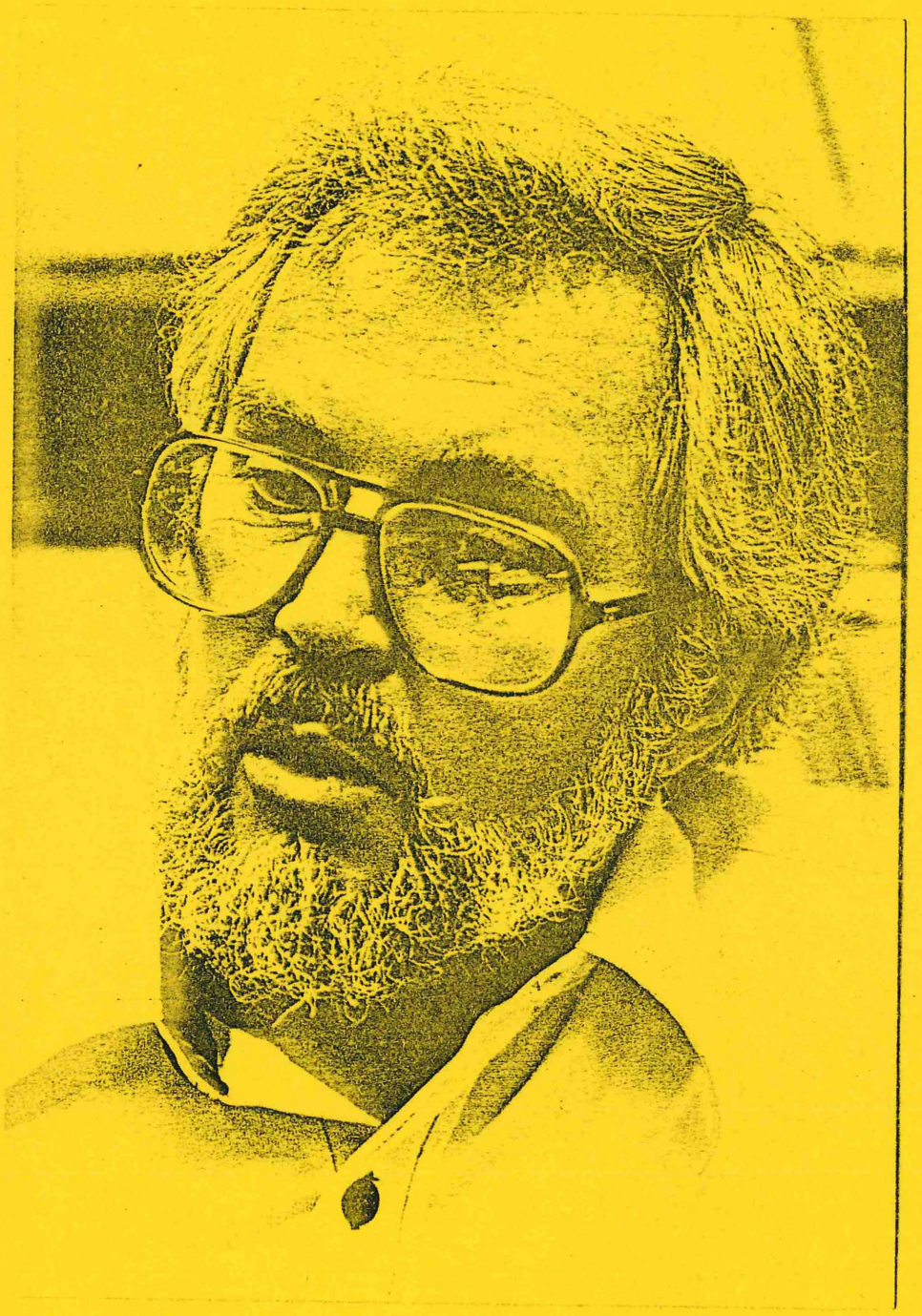
"I think the proposal has merits and I think it should be pursued further." (Hibbing)

"I would like to say that I'm not pushing at this time to put a few 100 thousand acres lease to Minnegasco but I am pushing for a pilot plant so that we can find out if this is feasible. I would like at least (30,000 acres) for a private pilot project that runs contiguous to their (Minnegasco) site (i.e. by Margie). I would like it contiguous to that thing as part of the 200,000 acres that they're asking for." (International Falls)

"There's a question to be answered here: Should the state appropriate funds for biomass? Possibly that's the best place they could put funds, rather than subsidies and that. I have to support the fact that the research funds continue so that we can answer so many questions that have been delivered here tonight, a lot of good concerns and a lot of good points were made. And dummies like me on whether it should be open mining or biomass, I can't answer that. But the economics to the community, such as the multiplier, I can understand that and I think we all can." (Hibbing)

IV.

BIOMASS ATTITUDE AWARENESS SURVEY



Biomass* - crop residues, wood and special energy crops - can potentially supply 17.9% of Minnesota's energy demand by the year 2000.[1] Projections show that traditional fuel supplies will increase only 10% by 1989 and then begin to decline, and that growing energy demand will begin to outstrip these conventional supplies by the late 1980's.[2] During this period and beyond, conversion of biomass material into fuel may become Minnesota's best energy resource.

Research is currently underway at the University of Minnesota and at two test sites - near Zim in St. Louis County, and on a farm north of Aitkin. The growth patterns and potential of cattails, and other special energy crops, including alder, willow and certain forms of aspen are being studied because of their importance as a future fuel resource. This biomass material can be converted into liquid and gaseous energy fuels. Such fuels could directly offset imports of petroleum and natural gas. In addition, biomass material, which will burn if sufficiently dry, is also attractive as a solid fuel that can meet thermal requirements through direct burning.

To increase local awareness of the potential of this natural resource, the Energy Division of the Department of Energy, Planning and Development launched a media campaign in the fall of 1981.

*Biomass is plant matter, including all direct or indirect plant matter waste. Formed by the photosynthetic conversion of water and atmospheric carbon dioxide by sunlight, it consists primarily of carbon, hydrogen and oxygen in the form of starches, sugars, cellulose, lignin and other hydrocarbons.

Sample sizes of 212 completed surveys were obtained for the "P" group and 191 for the "S" group, sufficient to achieve a confidence interval of $\pm$ 5% at a 0.95 confidence level.

The survey was conducted on weekdays in March during late afternoon and early evening hours. A copy of the survey instrument is contained in Appendix 2. Questions included whether respondents have heard of biomass, special energy crops or alternative energies; whether or not they think they are important; and what respondents think are the most appropriate funding sources for biomass research and development.

A summary of the responses for each group, P and S, and a demographic summary of respondents is given in Appendix 3. Please refer to that appendix for response figures not given in the text.

SURVEY RESULTS

1) Biomass Awareness

The results of the survey indicate a high level of awareness of biomass - crop residues, cattails and willow, alder and aspen - as an energy source among both groups of respondents. (See Tables 1 and 2).

83% of respondents in the publicized communities (P group) have either heard of biomass or one or more of its categories. 64% of respondents statewide (S group) are similarly aware. (See Table 3).

We also asked respondents if they have heard of wind or solar energy resources. Awareness of these alternative energy sources was very high - from 83% - 97%. (See Tables 1 and 2). However, just 15% of the P group had heard of only alternative energy sources,

and not biomass or any of its categories, while 34% of the S group had heard only of alternatives and not biomass.[6] (See Table 4). The generally higher awareness levels of all categories of biomass within the P group, may indicate that the press attention given to biomass was effective in increasing people's knowledge about the resource. One respondent in a publicized city specifically mentioned articles he had read in newspapers he received from a different, though publicized community. Newspapers are the most frequently mentioned information source - (66% of the P group and 48% of the S group) - although the difference among sources is not significant.[7]

Another factor contributing to the high awareness level in the P group may be the fact that most of the cattail and special energy crop resource area is in Northern Minnesota - the publicized cities area. (See map). In contrast, a higher level of awareness (36%) of crop residues over other biomass sources was shown by respondents in the southern portion of the state (area code 507), where most of the crops conducive to conversion are grown. (See map)

2) Importance of Biomass

We asked those respondents who were aware of biomass or its categories (Table 3) how important they thought biomass was as a fuel in Minnesota. Of those respondents in the P group, 84% (71% of the total sample) think it is important or very important that biomass be used as a fuel in Minnesota. Few people, 10% of the P group and 18% of the S group felt that biomass, in one form or another, is not at all or not very important as a fuel source in Minnesota. (See Tables 5 and 6).

Of the respondents who are aware of solar and wind energy sources only, (Table 4), 87% of the P group and 91% of the S group think it is important or very important to use these alternative energy sources in Minnesota. (See Tables 7 and 8).

Again, people in the nonpublicized area of the state, where the potential for special energy crops is not as great, do not put as high a value on biomass, however, they do feel that other sources of alternative energy are important.

The reasons most frequently given as to why biomass or alternative energies are not important are that it is not feasible, too much research is needed, and that that type of energy is too expensive. Answers given in the "Other" category include the belief that there is no energy shortage, or that other forms of energy, like wood, which is readily available now, should be used first.

3) Funding Sources

We then asked the respondents who think that either biomass or alternative energy sources are important what the appropriate sources of funding for research into development of these resources would be. Responses indicate that government involvement, in one form or another, is highly favored among those respondents. Only 10% of those respondents in the publicized group felt that private business alone should fund research, while 21% of the statewide group wanted private business funding only. The figures indicate that both groups of people favor state government funding, or some cooperative effort among private industry, university, and state and federal governments, with university funding receiving the lowest percentages of the four groups. (See Tables 9 and 10). Only 2%

of people in both groups think the state should specifically be excluded from funding, but that private industry, the federal government and universities may be involved.

Some people expressed unsolicited thoughts that the state is channeling tax dollars in the wrong directions now, and that it should put its money into alternative energy development, that it should do it quickly, and that this would be a better use of tax dollars.

The category "Other" for sources of funding received 12% of the P group's response and 7% of the S group. Comments included recommendations for foundations, cities and oil companies to back the research, and for the government to give tax incentives to individuals as funding and research sources.

Of the respondents who think that state government should not fund research into biomass and alternative energy development, 51% of the respondents in both groups said that the budget is too tight. This is not surprising since the State's budget problems have been in the news over the past several months. 24% of the P group and 23% of the S group said there were more important uses for the State money; 14% of the P group and 30% of the S group said this was not the type of thing government should do; and 41% of the P group and 20% of the S group gave "Other" as their response. Comments given by respondents in this "Other" category include: the energy shortage is a national problem and research into solving it benefits the whole country, so more federal money should be used; private industry is more efficient at research and gets more for its dollars invested than government; government is too slow and

inefficient and research would get caught up in red tape; government in general is involved in too many things and should get out of them; and that the State, specifically, has been given too many of federal government's responsibilities now and cannot handle more.

CONCLUSION

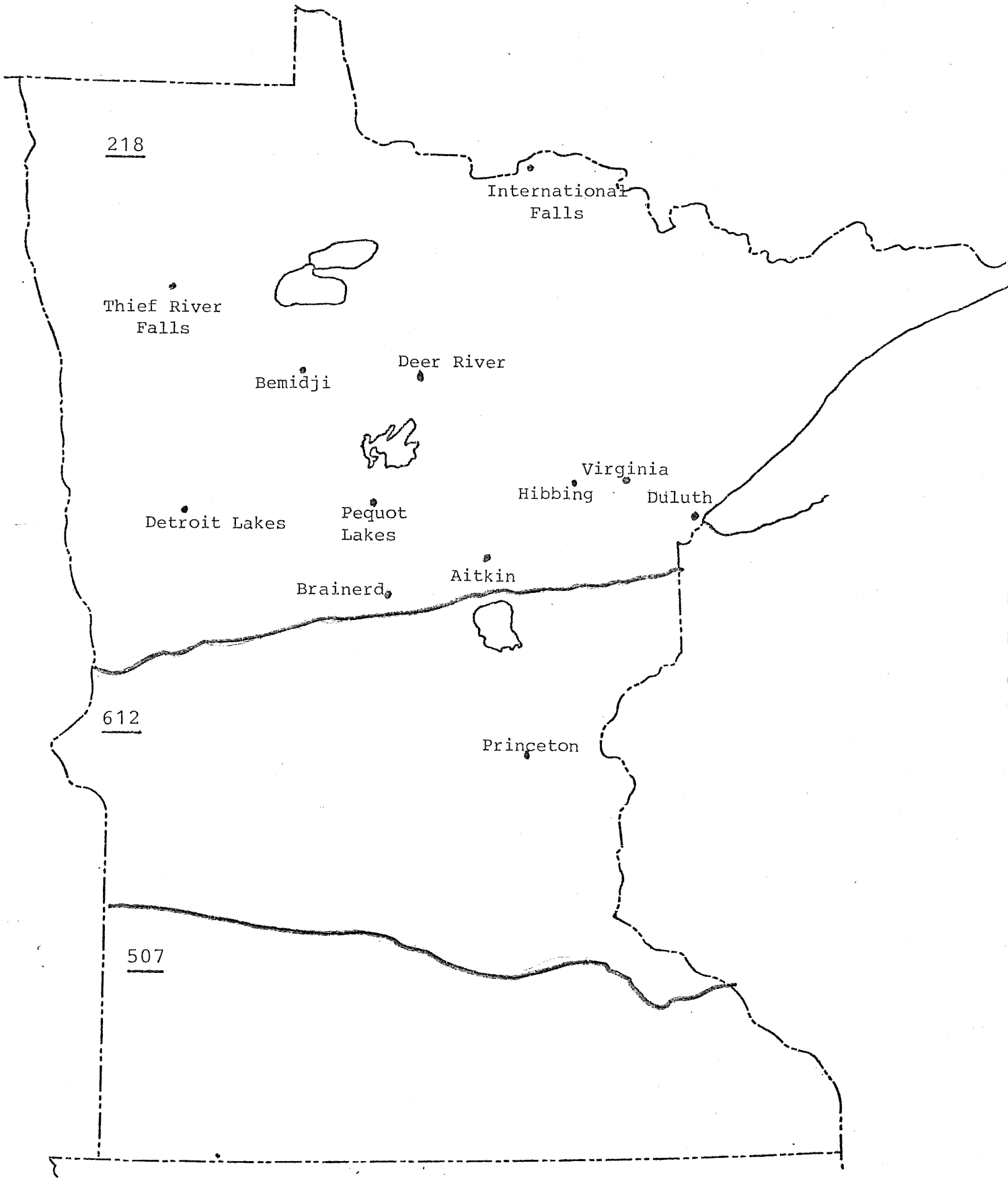
There is a high level of awareness of biomass - cattails, crop residues and special energy crops - as a potential energy source in Minnesota. Residents of northern Minnesota, areas of the state where the resource exists, and communities where publicity regarding this potential resource was strong, have a higher awareness level than residents in the state as a whole.

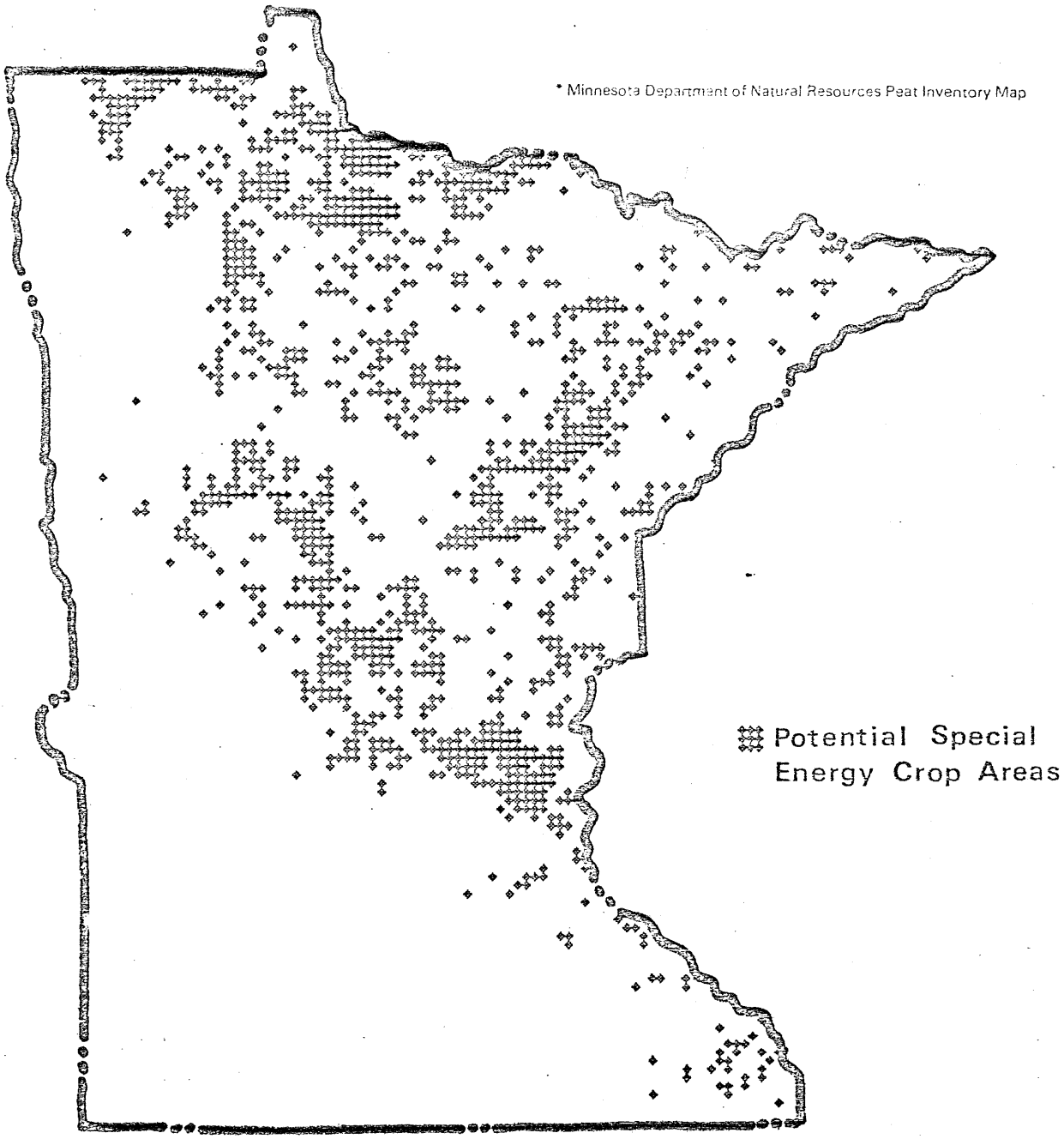
People throughout Minnesota think that these natural resources are important as future energy sources, that research should be done to develop them, and that the State should get involved in funding the research and development.

Survey respondents were quite positive and generally aware of Minnesota's energy situation. They were aware and in favor of alternative energy development, and they feel government should have a vital part in its implementation and development.

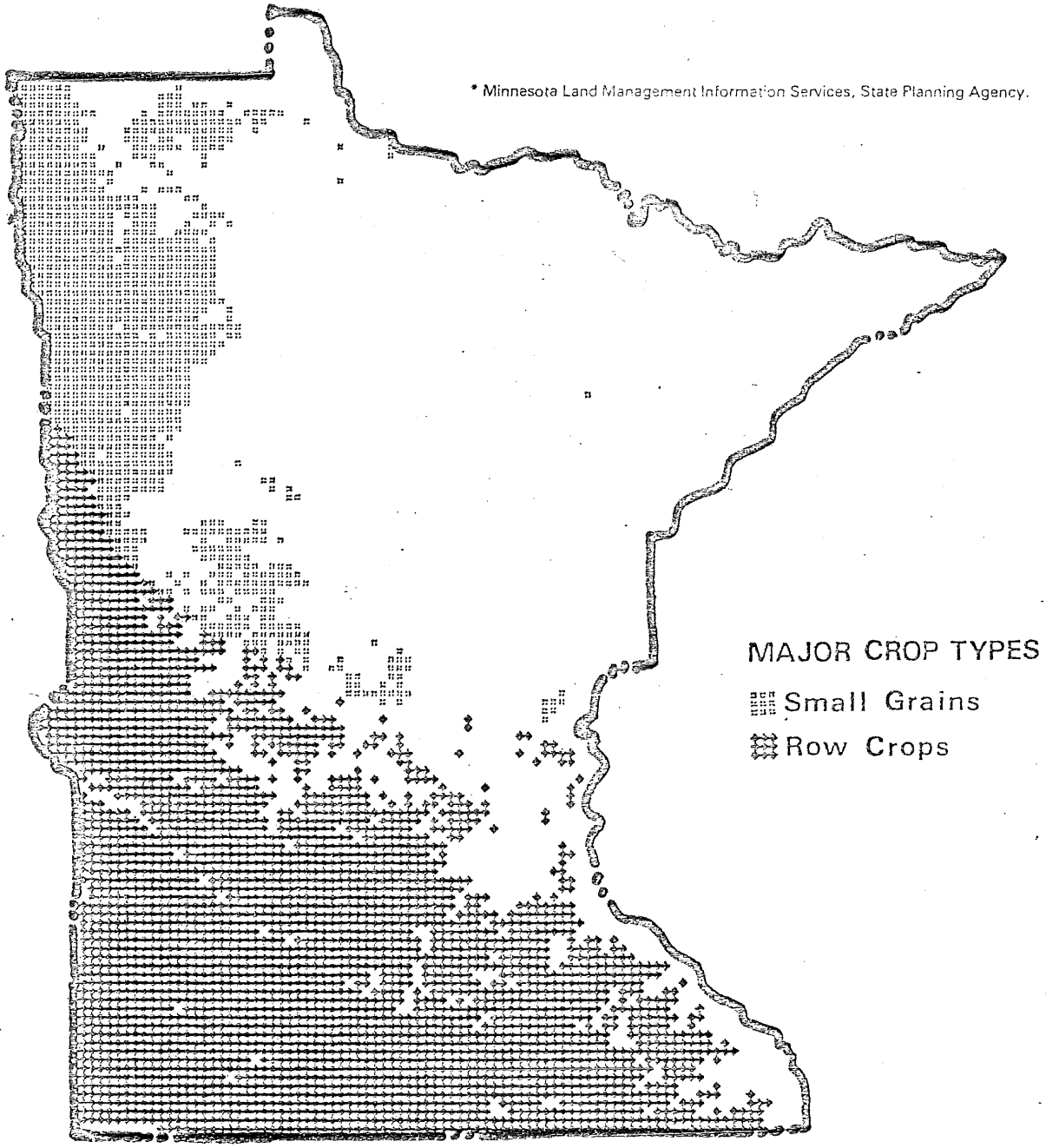
STATE OF MINNESOTA

PUBLICIZED CITIES





POTENTIAL SPECIAL ENERGY CROP LANDS



* Minnesota Land Management Information Services, State Planning Agency.

AGRICULTURAL CROP LANDS*

AWARENESS OF ALTERNATIVE ENERGY SOURCES

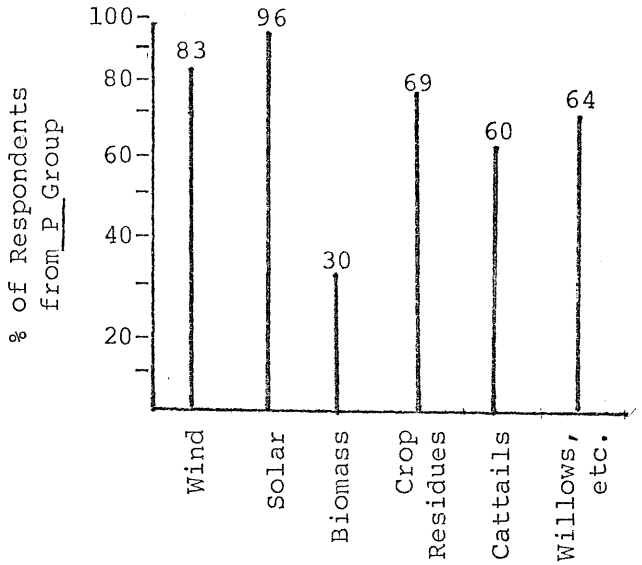


TABLE 1

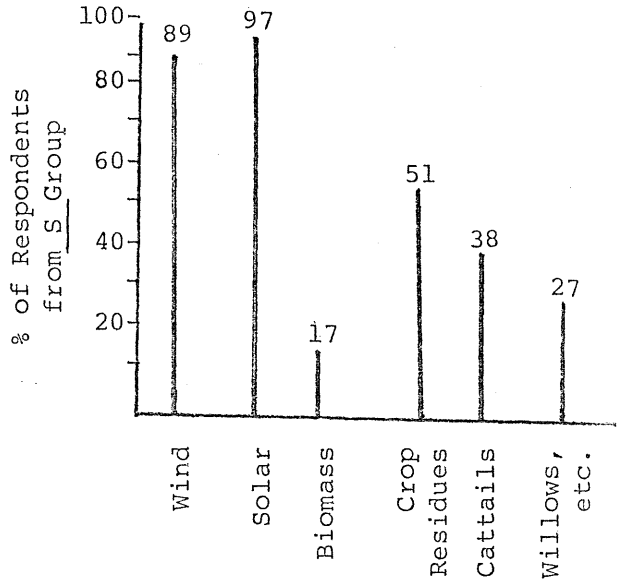


TABLE 2

AWARENESS OF ANY BIOMASS RESOURCE

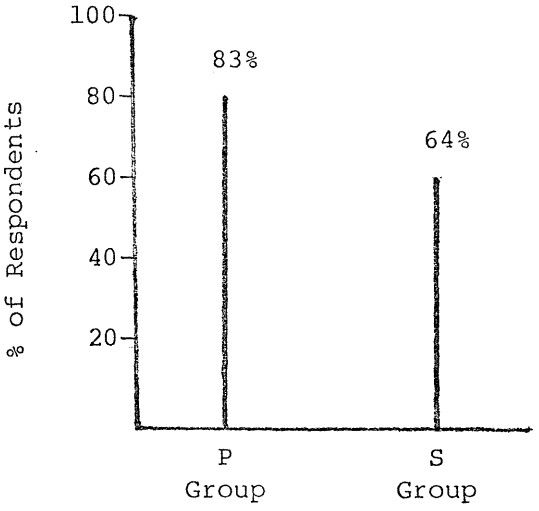


TABLE 3

AWARENESS OF WIND AND SOLAR ONLY

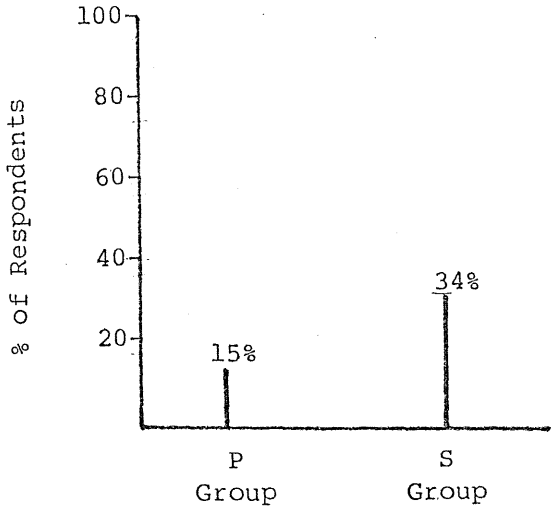


TABLE 4

IMPORTANCE OF BIOMASS
AS FUEL IN MINNESOTA

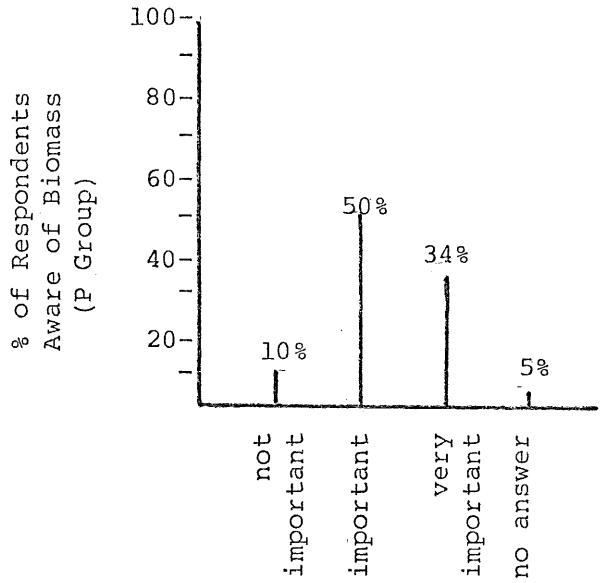


TABLE 5

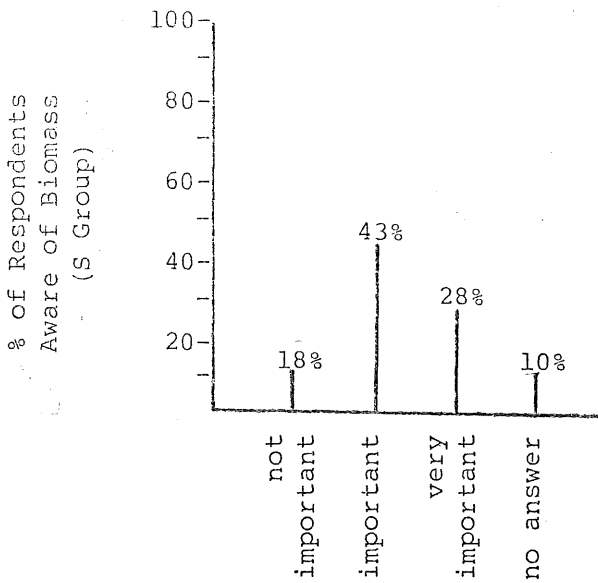


TABLE 6

IMPORTANCE OF ALTERNATIVE
OR RENEWABLE ENERGY SOURCES
IN MINNESOTA

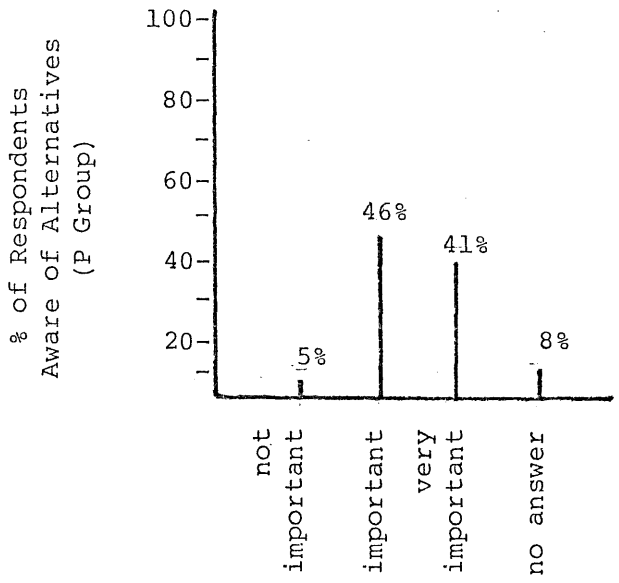


TABLE 7

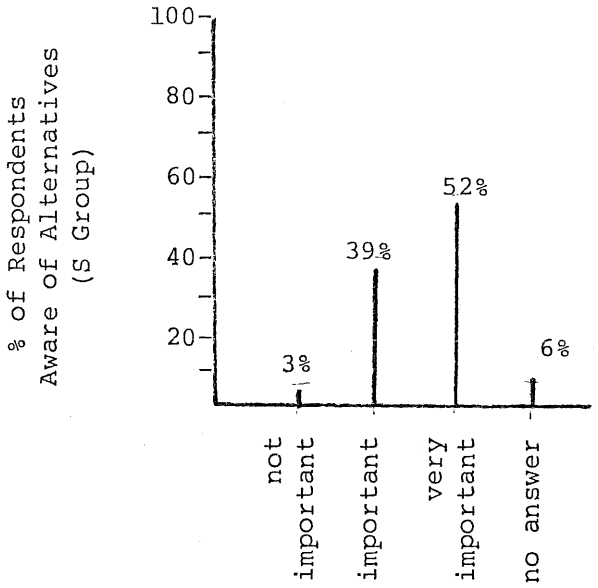


TABLE 8

APPROPRIATE SOURCES OF FUNDING
FOR BIOMASS & ALTERNATIVE ENERGY RESEARCH

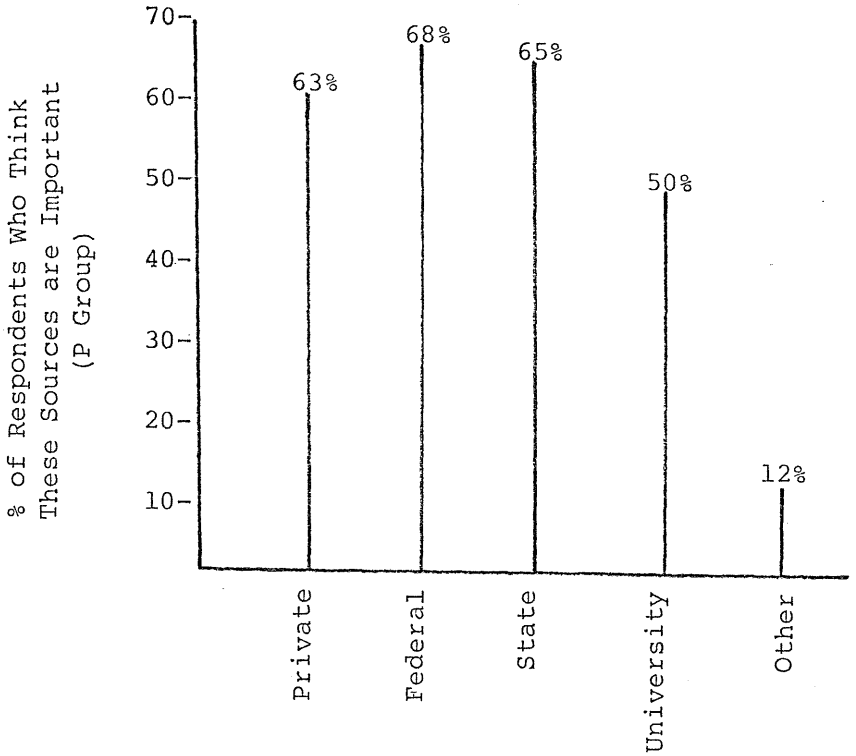


TABLE 9

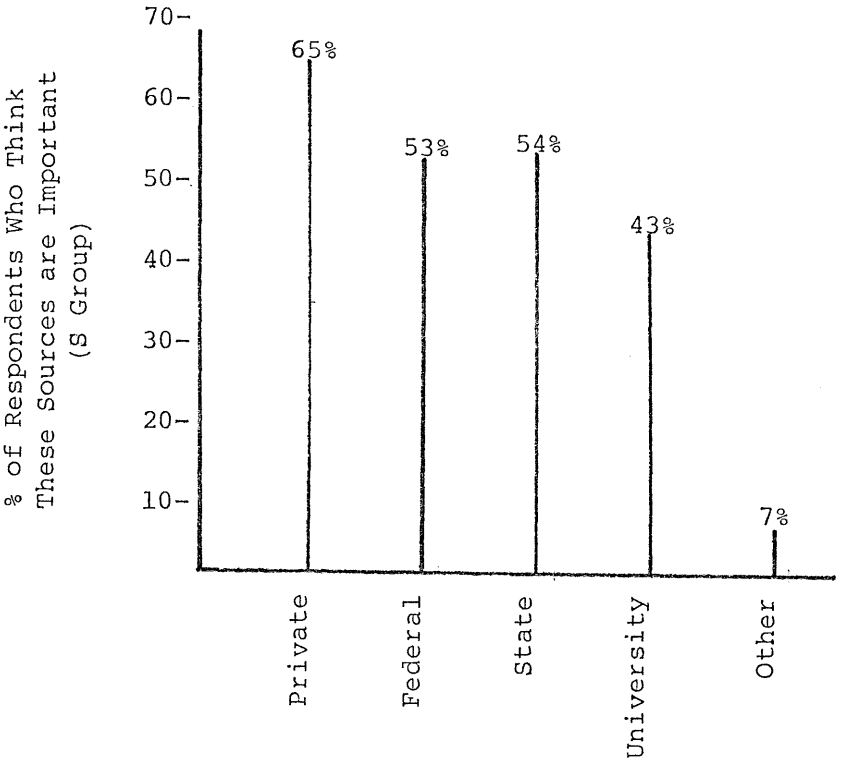


TABLE 10

FOOTNOTES

1. Minnesota Energy Agency. Alternative Energy Division. 1981.

2. Minnesota Energy Agency. 1980 Energy Policy and Conservation Report.

3. These cities include: Aitkin, Bemidji, Brainerd, Deer River, Detroit Lakes, Duluth, Hibbing, International Falls, Pequot Lakes, Princeton, Thief River Falls and Virginia. See map.

4. An estimated 17% of households in Minnesota are in area code 218; 66% are in area code 612, and 17% are in area code 507. In our statewide sample, 22% of the respondents were from area code 218, 56% from area code 612, and 22% from area code 507.

5. A chi square analysis of the education level of survey respondents revealed a significance of .05.

6. Everyone, in both groups, who had heard of biomass had also heard of alternatives.

7. There were also newspaper articles generated in towns that were not part of the Agency's publicity campaign - in Minneapolis and possibly other cities.

APPENDIX 1

SURVEY SAMPLE SELECTION PROCEDURE

Selection of Out-State Sample

1) Randomly select 60 phone books from all Minnesota phone books.

2) Sum up number of pages (less advertizing and instruction pages) for all phone book

$$= \Sigma \text{ pgs}$$

3) Divide this number by 294 (desired sample size plus nonrespondent error)

$$N = \frac{\Sigma \text{ pgs}}{294}$$

4) Start at a random page, selected by closing eyes and pointing to a spot in the stack of phone books (or some such procedure).

5) Select first name/number from every Nth page.

6) If first name is not a private residence select the next name.

Selection of Metro Area Sample

1) Use metro area phone books.

2) Repeat steps 2-6, except divide by 196 to calculate N.

Selection of Publicity Communities Sample

1) Use phone books for these communities.

2) Repeat steps 2-6, except divide by 350 to calculate N.

APPENDIX 2

BIOMASS SURVEY

Col.

1 Sample Identification Code _____ (P = publicized)
(N = not publicized)

Name _____

Address _____

City _____

2-11 Telephone Number _____ - _____ - _____

First Call _____

Second Call _____

****

INTERVIEWER BEGINS:

Hello, my name is _____.

I am calling from the Minnesota Energy Agency. The Energy Agency is interested in asking you some questions about your views on renewable energy sources. Your responses will be kept confidential. This survey should take about 5 minutes.

COL		CODE
12	1. WHAT IS THE PRIMARY FUEL YOU USE TO HEAT YOUR HOME?	(circle one)

FUEL OIL.....1
NATURAL GAS.....2
WOOD.....3
ELECTRICITY.....4
OTHER.....5

13-19 2. I'M GOING TO READ YOU A LIST OF DIFFERENT ENERGY SOURCES. TELL ME WHICH YOU HAVE HEARD OF: (check each response)

	NO (0)	YES (1)
FUEL OIL/NATURAL GAS.....	_____	_____
WIND.....	_____	_____
SOLAR.....	_____	_____
*BIOMASS.....	_____	_____
*CROP RESIDUES..... (LIKE CORN STALKS)	_____	_____
*CATTAILS.....	_____	_____
*WILLOWS,ALDER,ASPEN.....	_____	_____

****

* If answered "YES" to question 2 for knowledge of biomass, crop residues, cattails, or willows, etc., then ask 3A1 and 3A2.

****

20-26 3A1. HOW DID YOU LEARN ABOUT BIOMASS ENERGY CROPS? DID YOU LEARN ABOUT BIOMASS FROM: (check each response)

	NO (0)	YES (1)
NEWSPAPERS.....	_____	_____
BOOKS,MAGAZINES,PAMPHLETS..	_____	_____
TV/RADIO.....	_____	_____
CONVERSATIONS WITH OTHERS..	_____	_____
OTHER.....	_____	_____

****

Don't Remember.....	_____	_____
No answer.....	_____	_____

****

COL CODE

27 3A2. HOW IMPORTANT IS IT FOR ENERGY CROPS LIKE CORNSTALKS, CATTAILS, OR WILLOWS TO BE USED AS FUEL IN MINNESOTA? (circle one)

*NOT AT ALL IMPORTANT.....1
*NOT VERY IMPORTANT.....2
**IMPORTANT.....3
**VERY IMPORTANT.....4

****
No answer.....0
****

****

* If answered "NO" to question 2 for knowledge of crop residue, cattails, or willows, then ask question 3B.

****

28 3B. HOW IMPORTANT IS IT TO USE ALTERNATIVE OR RENEWABLE ENERGY SOURCES IN MINNESOTA? (circle one)

*NOT AT ALL IMPORTANT.....1
*NOT VERY IMPORTANT.....2
**IMPORTANT.....3
**VERY IMPORTANT.....4

****
No answer.....0
****

****

* If answered "NOT AT ALL IMPORTANT" or "NOT VERY IMPORTANT" to questions 3A2 or 3B, then ask question 4A.

****

29 4A. IF NOT IMPORTANT, WHY NOT? (circle one)

NOT FEASIBLE.....1
TOO MUCH RESEARCH NEEDED.....2
TYPE OF ENERGY TOO EXPENSIVE.....3
WOULD CAUSE ENVIRONMENTAL PROBLEMS.4
WON'T HELP ENERGY PROBLEMS.....5
OTHER.....6

_____

_____

****
No answer.....0
****

COL CODE

****

** If answered "IMPORTANT" or "VERY IMPORTANT" to questions 3A2 or 3B, then ask question 4B.

****

30-35 4B. WHAT DO YOU THINK WOULD BE APPROPRIATE SOURCES OF FUNDING FOR RESEARCH INTO DEVELOPMENT OF ALTERNATIVE/ENERGY CROPS? (check all appropriate responses)

	NO (0)	YES (1)
PRIVATE BUSINESS.....	_____	_____
FEDERAL GOVERNMENT.....	_____	_____
***STATE GOVERNMENT.....	_____	_____
UNIVERSITY.....	_____	_____
OTHER.....	_____	_____

****

No answer..... _____ _____

****

****

*** If answered "NO" to question 4B concerning "STATE GOVERNMENT", then ask question 5.

****

36-40 5. WHY DON'T YOU THINK STATE GOVERNMENT SHOULD FUND THIS TYPE OF RESEARCH? (check all appropriate responses)

	NO (0)	YES (1)
STATE BUDGET TOO TIGHT.....	_____	_____
MORE IMPORTANT USES FOR MONEY..	_____	_____
NOT THE TYPE OF THING GOVERNMENT SHOULD DO...	_____	_____
OTHER.....	_____	_____

_____

****

No answer..... _____ _____

****

****

Demographics - Ask Everyone.

****

COL CODE

41 6. DO YOU LIVE IN A TOWN/CITY OR IN THE COUNTRY (FARM OR UNINCORPORATED TOWNSHIP)? (circle one)

TOWN/CITY.....1
COUNTRY.....2

42-43 7. WHAT IS YOUR OCCUPATION? _____

****

List of Categories (circle one)

Manager/Administrator.....01
Professional/Technical Worker.02
Clerical/Sales Worker.....03
Craft/Kindred Worker.....04
Operatives.....05
Nonfarm Laborer.....06
Service Worker.....07
Farmer.....08
Homemaker.....09
Other.....10
No answer.....00

****

44 8. WOULD YOU TELL ME YOUR AGE GROUP? (circle one)

0-24.....1
25-34.....2
35-50.....3
51-64.....4
65 + ...5

****

No answer.....0

****

45 9. WHAT IS THE HIGHEST LEVEL OF EDUCATION THAT YOU HAVE COMPLETED? (circle one)

SOME HIGH SCHOOL.....1
HIGH SCHOOL GRADUATE.....2
SOME COLLEGE/VOCATIONAL SCHOOL.3
COLLEGE GRADUATE.....4
MORE THAN A BACHELOR'S DEGREE..5

****

No answer.....0

****

46 Interviewer should not ask this question. (circle one)

Male.....1
Female.....2

APPENDIX 3

BIOMASS* - STATISTICS SUMMARY

Following is a general tally of the responses to the survey questions for each group - publicized communities (P) and state (S).

The number of responses for the Total Sample (N) =

212 publicized cities

191 statewide sample

Q.2. Which of the following energy sources have you heard of?

N = Total sample (212 - P; 191 - S)

	P		S	
	N	(%)	N	(%)
Wind	176	83	170	89
Solar	204	96	185	97
Biomass	64	30	33	17
Crop Residues	146	69	98	51
Cattails	128	60	72	38
Willows, Alder, Aspen	135	64	52	27

Q.3. How did you learn about biomass energy crops?

N = Respondents who are aware of any biomass (175 - P; 122 - S)

	P		S	
	N	(%)	N	(%)
Newspapers	115	66	58	48
Books, Magazines, Pamphlets	87	50	45	37
TV/Radio	99	55	45	37
Conversations with others	68	38	46	38
Other	29	17	21	17

*For purposes of this summary, the word "biomass" also includes the categories crops residues, cattails, and willows, alder and aspen.

Q.3A.2. How important is it for energy crops to be used as a fuel in Minnesota?

N = Respondents who are aware of any biomass (175 - P; 122 - S).

	P		S	
	N	(%)	N	(%)
Not at all important	0	0	1	1
Not very important	19	10	22	18
Important	88	50	52	43
Very Important	59	34	35	28
No Answer	9	5	12	10

Q.3B. How important is it to use alternative or renewable energy sources in Minnesota?

N = Respondents who are aware of Wind or Solar only (37 - P; 69 - S)

	P		S	
	N	(%)	N	(%)
Not at all important	1	3	0	0
Not very important	1	3	2	3
Important	17	46	27	39
Very Important	15	41	36	52
No Answer	3	8	4	6

Q.4A. Why don't you think energy crops or renewable energy sources are important?

N = Respondents who answered "not at all" or "not very important" to questions 3.A2. or 3.B. (21 - P; 25 - S).

	P		S	
	N	(%)	N	(%)
Not feasible	0	0	6	24
Too much research needed	6	29	2	8
Type of energy too expensive	5	24	5	20
Would cause environmental problems	2	10	1	4
Won't help energy problems	0	0	2	8
Other	8	38	4	16

Q.4B. What do you think would be appropriate sources of funding for research into development of alternative/energy crops?

N = Respondents who think biomass and renewable energies are important (179 - P; 150 - S)

	P		S	
	N	(%)	N	(%)
Private business	113	63	97	65
Federal government	121	68	80	53
State government	116	65	81	54
University	90	50	64	43
Other	22	12	10	7

Q.5. Why don't you think State government should fund this type of research?

N - Respondents who said "no" to State government funding in Question 4B. (63 - P; 69 - S)

	P		S	
	N	(%)	N	(%)
State budget too tight	32	51	35	51
More important uses for money	15	24	16	23
Not the type of thing gov't should do	9	14	21	30
Other	26	41	14	20

DEMOGRAPHIC SUMMARY

PUBLICIZED COMMUNITIES

N = 212

Area Code: 218 - N = 200, 94.3%
612 - N = 12, 5.6%

Reside in town or city - N = 155, 73.1%
country - N = 57, 26.9%

Primary Fuel Used in Residence

Fuel Type	N	%
Fuel Oil	55	25.9
Natural Gas	65	30.6
Wood	56	26.4
Electricity	12	5.6
Other	27	12.7

Age Group

0-24	32	15.1
25-34	44	20.7
35-50	51	24.1
51-64	36	16.9
65+	47	22.2
No answer	2	.9

Sex

Male	88	41.5
Female	124	58.4

Education Level

Some high school	55	25.9
High school graduate	55	25.9
Some college/vocational school	63	29.7
College graduate	26	12.2
More than a B.A.	13	6.1

Occupation	N	%
Manager/administrator	5	2.3
Professional/technical worker	36	16.9
Clerical/sales worker	31	14.6
Craft/kindred worker	13	6.1
Operatives	15	7.1
Non-farm labor	12	5.6
Service worker	20	9.4
Farmer	4	1.9
Homemaker	42	19.8
Other	15	7.1
Unemployed	2	.9
Retired	20	9.4
No answer	1	.5

STATEWIDE

N = 191

Area Code: 218 - N = 42, 21.9%
507 - N = 43, 22.5%
612 - N = 106, 55.5%

Reside in town or city - N = 138, 72.2%
country - N = 52, 27.2%

Primary Fuel Used in Residence

Fuel Type	N	%
Fuel Oil	26	13.6
Natural Gas	108	56.5
Wood	24	12.5
Electricity	19	9.9
Other	10	5.2

Age Group

0-24	24	12.5
25-34	56	29.3
35-50	51	26.7
51-64	28	14.6
65+	31	16.2

Sex

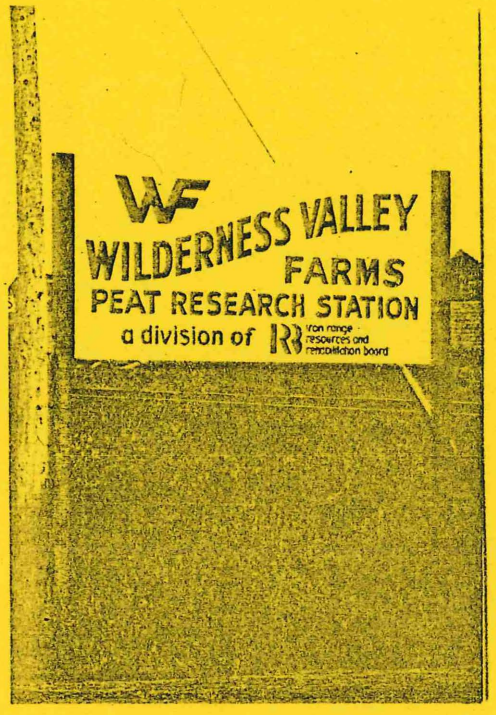
Male	81	42.4
Female	109	57.1

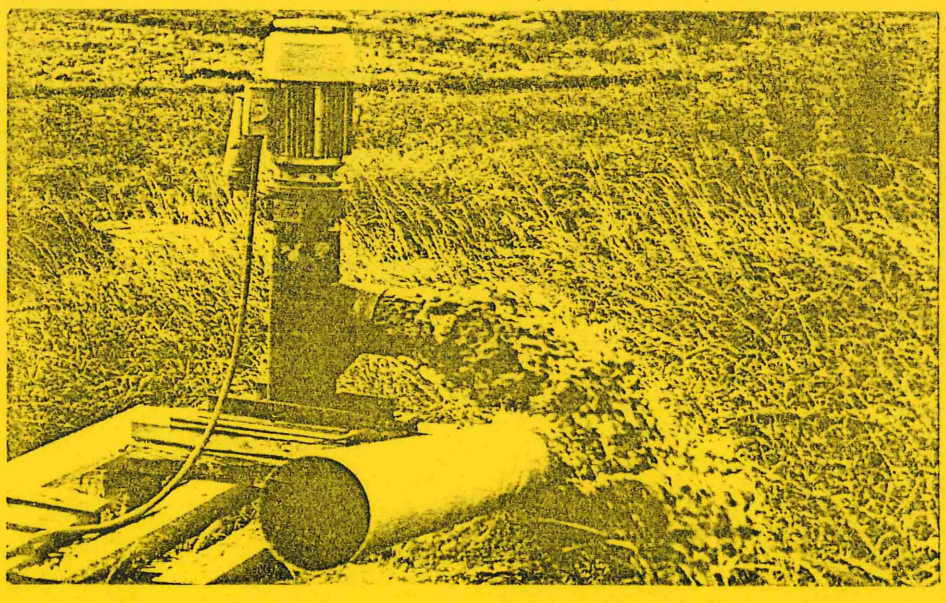
Education Level	N	%
Some high school	31	16.2
High school graduate	53	27.7
Some college/vocational school	53	27.7
College graduate	30	15.4
More than a B.A.	23	12.0
No answer	1	.5

Occupation		
Manager/administrator	6	3.1
Professional/technical worker	49	25.6
Clerical/sales worker	28	14.6
Craft/kindred worker	10	5.2
Operatives	15	7.8
Non-farm worker	6	3.1
Service worker	16	8.3
Farmer	15	7.8
Homemaker	32	16.7
Other	6	3.1
Unemployed	0	0.0
Retired	2	1.0
No answer	2	1.0

V.

CURRENT STATUS: PEATLAND MANAGEMENT ACTIVITIES





Current Status: Peatland Management Activities

Since the release, in summer 1981, of the Peat Program Final Report and Policy Recommendations to the Legislature, the Department of Natural Resources and the other agency members of the Interagency Peat Task Force have worked to enunciate a rational development process for the state's peatlands. An aspect of this is the recent work of the DNR Peat Program to map peatlands of highest suitability for the variety of uses recommended in the Department's policies. Before discussing the findings of this mapping process, however, a short review of the state's peatland management policies is provided below.

Peatland Policies Overview

+ To encourage a diversity of uses (not only energy but horticulture, forestry, wildlife, and others);
+ To offer leases for up to 3,000 acres in public (sealed bid) lease sales;
+ To maintain northern Minnesota's high quality of environment by requiring:
  - Monitoring of air and water connected with peat mining operations or peatland drainage,
  - Impact control measures, such as settling ponds for bog outlets,
  - Reclamation of all mined or disturbed leased state peatlands, and
  - Protection of peatlands with unusual characteristics or value for wildlife, forestry, or continuing scientific study.

Current Policy Status

The DNR is currently encouraging proposals for peatland leasing. To date, one bog (West Central Lakes) has been leased to a prospective horticultural and energy peat producer. Other bogs will be offered as interest is expressed. There are no barriers at the state level to immediate initiation of the leasing process, should interest be expressed.

The only barriers to the initiation of a peat-based industry in Minnesota are economic and, to some extent, technical. Peat may initially not be able to compete with cheaper coal. In the short run, some economic boost may be required to establish the economic feasibility of peat fuels. Once a market is created and demand established economic subsidy might be diminished or dispersed with. It is likely that the economic and employment benefits of initiating a peat-based energy industry will outweigh the costs.

Current Peatland Management Efforts

The identification of peatland areas suitable for horticultural or energy mining (as well as other development types) is a principal management activity of the DNR Peat Program. Using information being gathered by the Peat Inventory Project we are identifying the depth, quality, extent, and location of Minnesota's significant deposits. To date, the important peat resource counties of St. Louis (the SW part), Koochiching, Aitkin, Beltrami (northern part) and Lake of the Woods have been surveyed and sampled. Reports describing peat characteristics in these counties are available for St. Louis and Koochiching, nearly available for Aitkin, with the balance of reports to be made available over the next 18 months.

The maps produced by the peat inventory project are excellent resource maps by themselves. However, we have added further to their utility by encoding their information in the LMIC computer files. This step permits the combination of peat resource information with the plethora of cultural and physical information existing in the LMIC files.

Computer maps can be produced through this means to show peat resource characteristics in combination with, for example, peatland ownership,

accessibility, distance from cities, water proximity of peatlands, presence of forest cover types, and many other variables.

Recently, the program produced computer maps that identify peatlands satisfying three current state management needs, specifically:

- -the need to protect some categories of peatland from development (examples-wildlife lands, forest resources, high amenity areas and areas of scientific interest)
- -the need to identify areas of peatland available for immediate development
- -the need to allocate the balance of the state's resource to a peatland reserve from which, should future requirements dictate, acres could be withdrawn for a variety of uses.

The map following this narrative shows the peatlands in an eight-county region in northern Minnesota that appear to be suitable and available for immediate development. Of course, more detailed site analysis and inventory will be required to identify sites for concrete development proposals. Specifically, the map shows areas of peatland in the 8-county region that:

1. are at least 1000 acres of contiguous bog in size;
2. are no farther than 51 miles from one of the communities of International Falls, Grand Rapids, Duluth, Hibbing, Virginia, and Bemidji;
3. are within one mile of a road access point, but no part of the bog is farther than 6 miles from the road;
4. are not in recommended protected status (wildlife management areas, or unique areas);
5. are state-owned and, therefore, leaseable.

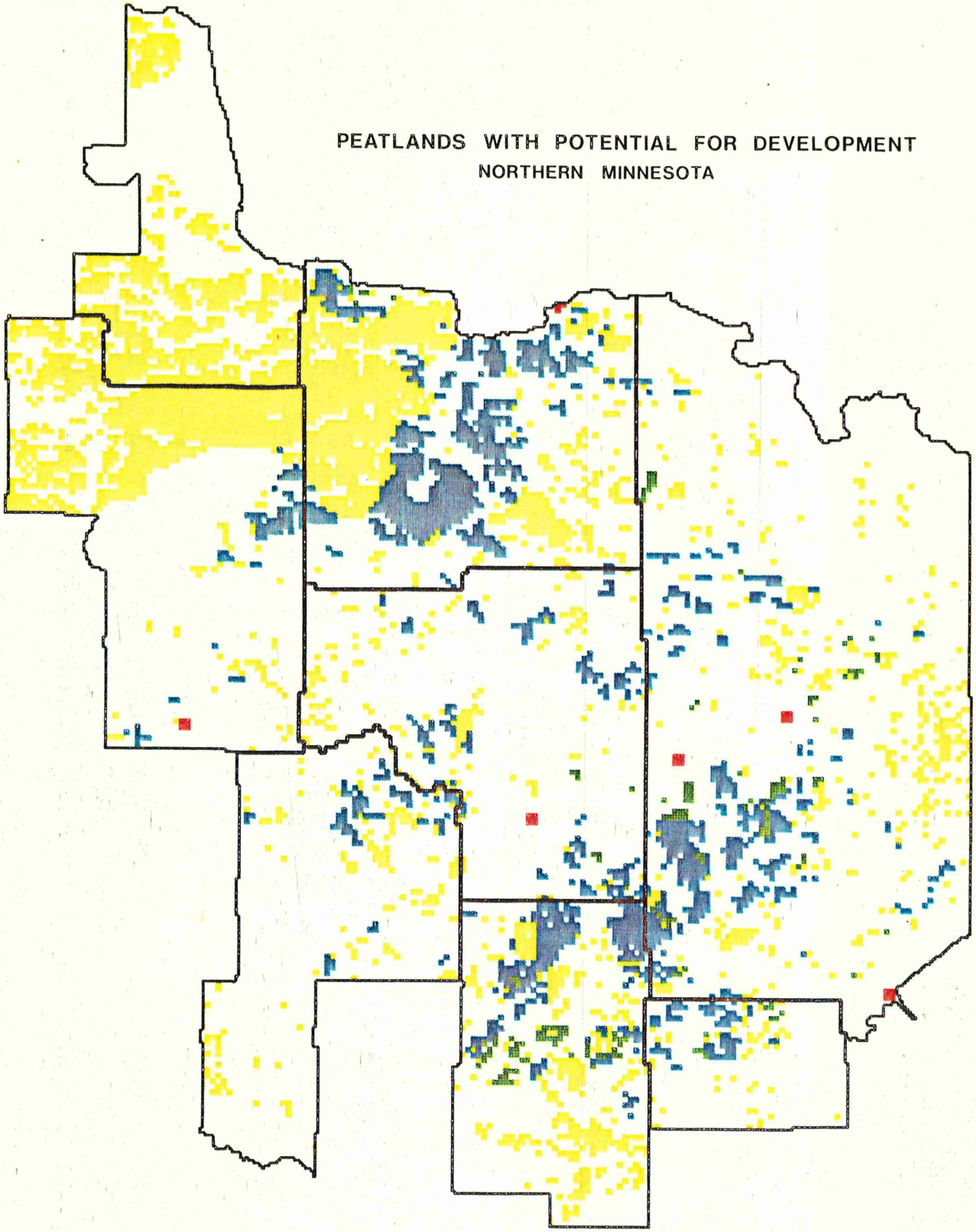
Peatlands with immediate development potential total nearly a million acres. However, due to technical difficulties in computer programming, we have not yet identified the depth factor for these peatlands (mining requires at least 5 feet). A guess would be that 20 to 30% of the total are peatlands greater than 5 feet in depth. Of course, the shallower acreages could have value for bioenergy crops, forestry or agriculture. In addition,

there are 123,000 acres of private peatland holdings and over 2.5 million acres of peatland reserve, which includes areas that are currently inaccessible, smaller than 1,000 acres, protected, or in protected ownership categories such as tribal lands, state and national parks, the BWCA and so on.

Summary

Finland, a country rich in peatlands and advanced in peatland development and management, has about 100,000 acres under production currently. From this plus some additional acreage to be added about 10 percent of the nation's energy needs will eventually be provided. The Minnesota Peat Program has identified, through its computer mapping activities, between 200,000 and 300,000 acres of deep, available, and accessible peat that could be leased in 3,000 acre units by the state to private sector producers, assuming environmental and other rules be satisfied. This resource and our state policies, the Inter-Agency Task Force believes, set the state for the kind of peat-based energy industry thriving today in northern Europe.

PEATLANDS WITH POTENTIAL FOR DEVELOPMENT
NORTHERN MINNESOTA



SYMBOL	COUNT	PERCENT	ACRES	LEGEND
1	95	0.1	15200.0	CITIES: BEMIDJI, DULUTH, GRAND RAPIDS, HIBBING, INTERNATIONAL FALLS, VIRGINIA
2	6334	6.8	1013440.0	STATE AVAILABLE
3	704	0.8	112640.0	PRIVATE
4	13445	14.5	2151200.0	OTHER PEATLANDS
5	72260	77.8	11561600.0	MINERAL OR WATER

VI.

ECONOMIC POTENTIAL OF ALTERNATIVE ENERGY DEVELOPMENT

Fig. 1-4 The Effect of Economic Growth

Economic growth shifts the boundary outward and makes it possible to have more of all commodities.

ECONOMIC POTENTIAL OF ALTERNATIVE ENERGY DEVELOPMENT

Resource Size

Minnesota's alternative energy resources can be divided into three broad categories: renewable resources, peat, and district heating. Renewable resources include solar, wind, hydro and biomass. Biomass includes wood and wood residues, farm animal and urban wastes, agricultural crops and their residues, and special energy crops.

Although Minnesota has no traditional sources of energy, it does have vast quantities of alternative energy resources. Current estimates of the energy available from renewable resources amount to almost 4,000 trillion Btu annually. Renewable resources could provide this amount of primary energy each year without being depleted. Minnesota's non-renewable energy resources in the form of peat deposits contain 53,000 trillion Btu. In addition, district heating could supply up to 44 trillion Btu each year.

Minnesotans consumed 1,080 trillion Btu of energy in 1981. At this level of consumption, Minnesota's renewable resources could provide 3.7 times the annual energy demand in the state. Peat could provide energy for 49 years before being depleted. District heating systems would provide a portion of a year's supply of energy.

Renewable resources, if properly managed, and if economics were not a consideration, could meet all of the state's energy needs for the foreseeable future. However, Minnesota's energy resources would be costly to produce, but there is some evidence that in the long run they would cost no more than coal from western states and less than petroleum and natural gas.

Solar, wind and hydro resources are free for the taking, but require capital equipment to create useable energy. Biomass resource production costs are uncertain and require more research, and pilot studies.

Market Potential

At the present time, Minnesota's energy resources are hardly used. District heating systems now supply about 2.3 trillion Btu of energy each year. Wood and wood residues burned by households and the wood products industry supply about 20 trillion Btu of energy annually. Hydro supplies 3.6 tillion Btu each year. Energy from these three sources supplied 2.4% of Minnesota's 1981 energy demand.

The rate at which the development of Minnesota's energy resources will increase has been the subject of much speculation. One scenario developed by the Minnesota Department of Energy, Planning and Development shows that Minnesota sources of energy could provide 12% of the state's energy demand by the year 2000. This scenario assumes that government incentives and deregulation will eliminate some of the barriers to alternative energy development.

Once an energy resource has been identified and its development costs ascertained, the next stage in the energy production process is to identify possible technologies to convert the resource to energy. Solar, wind and hydro conversion technologies are fairly well understood, and solar collectors and windmills are widely available. However, they have not fully penetrated the energy market as yet.

Biomass to energy conversion technologies are also well defined, but much engineering remains to be done. By far the largest renewable biomass resource is special energy crops, which can use the same conversion technologies as peat. In broad terms, the energy conversion possibilities for peat or biomass consist of direct burning, gasification and liquefaction.

Direct burning of biomass can occur on a small scale as in a residential stove or furnace, or on a large scale as in an electric power production plant. Gasification could be done by a farmer, an industry or a large natural gas utility. The resulting gas could be used on site or put into an existing natural gas pipeline, depending on its energy content.

Liquefaction produces an alcohol fuel that can be substituted, with minor equipment modifications, for fuel oil or gasoline. At the present time, liquefaction requires a very inexpensive energy resource (such as urban waste) to be cost-effective. Liquefaction has a greater market potential than gasification because of the large size of the liquid fuel market.

Cost estimates for biomass energy conversion technology are based on laboratory-scale models or demonstration units.. Experience with commercial scale facilities is limited. However, more is known about biomass conversion costs than resource costs at this time. Many of the conditions which will impact development of Minnesota's energy resources are unique to Minnesota and require in-state investigation.

Macro-economic Impacts

Using the scenario in which Minnesota energy resources supply 12% of the state's year 2000 energy needs, 22.7 trillion Btu would be supplied by synthetic gas from biomass. If this gas is produced in a large scale facility,

it's cost range would be $5.07 to $7.02 per million Btu (MMBtu) in 1981 dollars. This represents a cost savings of up to $1.69/MMBtu compared with Alaskan natural gas, also in 1981 dollars. The gross cost savings to the state could be as much as $38 million annually. This amount of gas corresponds to only 14% of the energy that could be produced from Minnesota resources by the year 2000.

Besides the direct cost savings, there are additional economic benefits associated with developing indigenous energy resources. These benefits are called the multiplier effect. To buy traditional forms of energy, Minnesotans send money to energy producing states or countries. If that money was spent in Minnesota, it would become income for Minnesotans, who would spend it again and make even more income for Minnesotans. For most dollars spent in Minnesota, the multiplier doubles or triples the economic effect, producing two or three dollars of income for each dollar spent. However, for money spent on traditional energy sources, the multiplier can be as low as 0.53, compared with over 2.3 for Minnesota resources.

The combined impacts of direct cost savings, the multiplier effect and energy conservation could generate more than one billion dollars of additional gross state product annually by the year 2000. These benefits would be enjoyed by all Minnesotans, not just those in the new energy industries. The billion dollar increase in gross state product would result from an alternative energy market penetration of only 12%. If the Minnesota energy industry grew to 29% of total energy demand, the benefit to gross state product would be in excess of $7 billion.

These monetary benefits do not include the psychological benefits of reduced dependence on foreign oil and reduced air pollution. The psychological benefits cannot be quantified but add a further preponderance of support for developing Minnesota's energy resources.

Summary

Minnesota has access to enough renewable resources to provide 3.7 times the current level of energy demand. In addition, the state has peat and district heating potential to supply all the state's energy needs for 49 years. In order for these resources to supply 12 percent of the state's year 2000 energy demand, more needs to be known about them, and the costs of biomass resource production is of particular importance. Incentives may be necessary to overcome financial, attitudinal, informational and institutional barriers to alternative energy development. If these barriers can be overcome, Minnesota's energy future is bright.