FINAL REPORT

OF THE

HOUSE SELECT COMMITTEE ON ENERGY

TO THE

MINNESOTA LEGISLATURE

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PREFACE

Perhaps we could have called our Minnesota ancestors the "wood, water, and wind people" because of their use of native renewable energy. More recently we in Minnesota have been depending almost entirely upon imported energy sources. But of the traditional sources, oil is being cut back, natural gas prices will triple by 1985, and coal causes environmental and transportation problems. Also, citizen resistance to power lines and pipelines compounds the problem of delivery.

We therefore as Minnesotans, must respond courageously and creatively to our new energy dilemmas. Almost every decision we make relates to energy--it is so pervasive. We are all energy decision makers--consumers, suppliers, regulators, legislators--and it is our many decisions that make energy policy, implicit or stated. Our lifestyles and voting records establish energy policy by action or by neglect. But because of our imminent energy crunch our energy decisions and policy must become more conscious in our lives and courageous in our legislation.

This report is an expression of many people--citizens, legislators, suppliers, regulators, staff--who in a brief six months (punctuated by summer vacations and political campaigns) met, talked, listened, traveled, learned, deliberated, and finally voted. We hope this report is the stimulus for your deeper interest and involvement in energy decisions, particularly for legislative action.

It was House Speaker Martin Sabo who convened us as the Select Committee on Energy in May of 1978, with the mandate to deliver these recommendations to the 1979 Legislature. Here they are! I hope they help us all better prepare for Minnesota's increasing energy crunch.

Our Committee is indebted to many people who expressed genuine concern and creative insight during our many statewide and Capitol meetings. As Chairman, I would like to thank the Committee members for giving so much time, even during their re-election campaigns. I especially wish to thank the Subcommittee Chairmen, Russell Stanton, Robert Vanasek and Pete Petrafeso, for their commitment to their special responsibilities. Very special thanks are in order for Sam Rankin, Legislative Analyst with House Research, who in a very thoughtful and thorough way helped to guide the Committee's deliberations and our final recommendations. Giving us excellent assistance also, were Sara Meyer and Jane Anderson, acting as Administrative Assistants, and Betty Goihl as Committee Secretary.

The task for all of us, of course, has just begun, but this phase of our involvement in energy decisions has truly been very gratifying.

Ken Nelson, Chairman
House Select Committee on Energy

THE HOUSE SELECT COMMITTEE ON ENERGY

FINAL REPORT

CHAPTER I

INTRODUCTION

The House Select Committee on Energy was established by Speaker of the House, Martin Sabo on May 23, 1978. The Committee was comprised of three members from each of eight standing committees of the House of Representatives--Agriculture, Appropriations, Commerce and Economic Development, Environment and Natural Resources, Governmental Operations, Local and Urban Affairs, Taxes, and Transportation. These committees were selected for representation on the Select Committee because during the past few legislative sessions they have each been asked to deliberate on energy related issues. Representative Ken Nelson (Minneapolis) was appointed chairman of the Select Committee. Committee membership may be found in Appendix 1.

Minnesota has been acknowledged as a leader among the states for enacting numerous energy conservation measures and making preparations for dealing with energy supply emergencies. Because a number of conservation measures and policy statements on conservation originated in the House Environment and Natural Resources Committee, Speaker Sabo asked the Select Committee to concentrate its efforts on other areas. Three areas of concern that seemed to fit less well into the standing committee structure employed by the House were 1) development of appropriate alternative energy systems for Minnesota, 2) issues of energy cost and energy pricing, and 3) the impacts of energy on the economic development of Minnesota.

Early in its existence the Select Committee established tentative guidelines by which issues for consideration would be identified. The criteria included the following: the issue 1) must be of pressing concern to Minnesota, 2) must be amenable to legislative action, 3) must be appropriate for state rather than federal action, and 4) must be appropriate for legislative action in the near term.

In order to accomplish the charge to the Select Committee, three subcommittees were appointed. The Subcommittee on Energy Cost and Pricing was chaired by Representative Robert Vanasek (New Prague), the Subcommittee on Alternative Energy Sources by Russell Stanton (Arco), and the Subcommittee on Energy and Economic Development by Pete Petrafeso (St. Louis Park). Each of the three subcommittees embarked on a heavy schedule of public meetings held both in St. Paul and around the state during the summer and early fall of 1978. The meeting dates, locations, and topics covered are detailed in Appendix 1. The committee compiled a mailing list of over 400 names and informed the press of all Committee activities. Summaries of all full Committee and Subcommittee meetings were prepared and distributed to all who expressed an interest in receiving them. Copies of all meeting summaries are available for loan from the Minnesota Legislative Reference Library.

By the middle of October, the Subcommittees had concluded all public hearings and began to draft specific recommendations for consideration by the full Committee. Beginning December 1st, the full Committee held a series of meetings at which were heard reports from the three Subcommittees. Recommendations presented by the Subcommittee reports were heard and debated by the full Committee. Some were accepted, some amended, and still others rejected. This report represents the final work product of the Committee. The House Select Committee on Energy officially terminated its activities on December 15, 1978.

CHAPTER II

MINNESOTA'S ENERGY HISTORY AND FUTURE

A. Trends in Minnesota Energy Use and Cost

Energy used in the early days of Minnesota's settlement came from resources available within the state--wood, wind, and hydro-power. During the second half of the nineteenth century these domestic energy sources declined in importance and the importation and consumption of coal increased. By 1900 coal supplied 90 percent of the country's energy demands. Coal likewise had emerged as the primary fuel in Minnesota for transportation, domestic heating and cooking, and industrial use. Because Minnesota has no deposits of coal, it was imported from coal fields to the east and south.

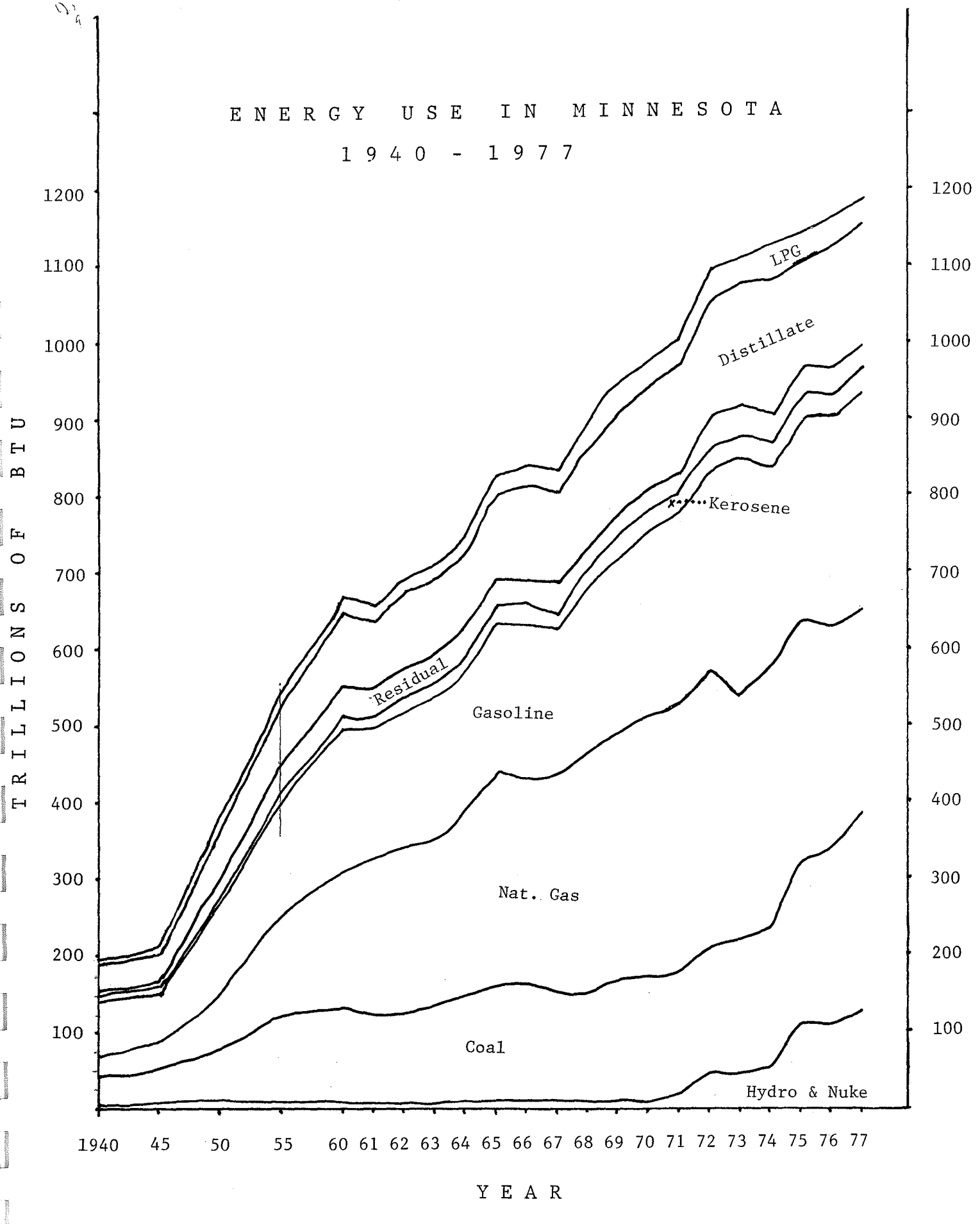
The twentieth century witnessed a second dramatic shift in fuel usage. This time petroleum and natural gas rapidly replaced coal as the country's primary energy source. This substitution of fuels was prompted by the increasing availability of petroleum and natural gas, both of which were cleaner, cheaper, and easier to handle than coal. Today, petroleum and natural gas are Minnesota's major sources of energy. As with coal, Minnesota has no deposits of oil or gas and thus must import them from other states and Canada.

The change in types of energy consumed has been accompanied by an increase in total energy consumption. Because petroleum and natural gas provided a cheap, plentiful source of energy, increased consumption was encouraged by declining real prices for energy, volume discounts offered by suppliers, advertising of energy-consuming goods, and energy intensive changes in transportation. During the 1940's, 50's and 60's, consumption of petroleum and natural gas increased exponentially in the United States and in Minnesota. Total petroleum consumption surpassed domestic production and the United States began to import moderate quantities of foreign oil. Figure 1 on page 5 is a graph depicting total energy use in Minnesota from 1940 to 1977.

In the late 1960's and early 1970's, domestic production rates for petroleum and natural gas remained essentially fixed or began to decline while consumption continued to climb. The gap widened between United States energy demand and domestic energy production. As a result, the United States became increasingly dependent on energy imports from other countries, including Canada. The Arab oil embargo in November 1973, coupled with a quadrupling of the world market price per barrel of crude oil, made the "energy crisis" a national issue.

The emerging shortages of petroleum combined with dramatically increased prices led to government and private activity aimed at increasing energy supplies and decreasing energy demand. The United States has accelerated efforts to locate and develop new domestic sources of the traditional fuels. Concurrently, greater attention has been focused on the utilization of renewable energy sources and on conservation measures.

Each state is in a unique position with respect to energy supply and demand. Some of the factors which differ from state to state include native energy resources, mix of fuels used, end uses of energy, and per


ENERGY USE IN MINNESOTA
1940 - 1977
TRILLIONS OF BTU
1200
1100
1000
900
800
700
600
500
400
300
200
100
LPG
Distillate
Kerosene
Residual
Gasoline
Nat. Gas
Coal
Hydro & Nuke
1940 45 50 55 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
YEAR

capita energy consumption. Minnesota is in a particularly vulnerable position in terms of traditional energy supplies. As noted earlier, the state has no native resources of petroleum, natural gas, or coal. It currently is heavily reliant on other states and Canada for its primary energy sources. However, Minnesota does have resources which could be used as new sources of energy. Traditional and new energy sources for Minnesota are described briefly below.

Major petroleum products refined from crude oil include motor gasoline, various grades of heating fuels, and diesel fuel. Minnesota consumes most of its petroleum in the form of gasoline and heating oil. In the past, Minnesota's crude oil supplies came primarily from the Prairie Provinces of Canada and were refined in the four Minnesota area refineries. Canada is now curtailing crude oil exports to the United States and plans to eliminate them entirely by 1985. Replacement supplies of crude oil or refined petroleum products for Minnesota will have to originate, in part, from OPEC countries, Alaska's North Slope, and Gulf Coast offshore deposits, as well as increased production from onshore deposits in the American Southwest. These replacement supplies will be more expensive than current petroleum sources and, like the original supplies, eventually will be depleted.

Natural gas is used in Minnesota primarily for residential and small commercial space heating and water heating. It also fuels some industrial processes such as bread baking and drying milk and grain and is used in glass and can manufacturing. Minnesota's natural gas supplies traditionally have come from gas fields in Texas, New Mexico, Oklahoma, and Kansas. Because new reserves in these states are becoming harder and more expensive to find, more of Minnesota's supplies will have to come from offshore areas in the Gulf of Mexico and possibly from northern

Alaska. As with petroleum, long term supplies of natural gas appear to be declining.

Liquified petroleum gas (LPG; also known as propane) originates both from natural gas wells and as a by-product of crude oil refining. Its major use in Minnesota is for residential and commercial space heating in rural and suburban areas. It also is used to dry grain, power farm equipment, provide a back-up fuel for industry, and to supplement utility natural gas supplies during peak usage periods. Because propane is a more expensive fuel than petroleum or natural gas, it is used when the less expensive fuels are unavailable or insufficient. Propane supplies are largely dependent on the production of natural gas and thus, like natural gas supplies, appear to be declining.

The major use of coal in Minnesota is for generating electricity. Coal is also used by the taconite, food, and paper industries. The rapid rise in petroleum and natural gas prices has led a number of industries to convert to the use of coal. From 1971 to the present, Minnesota's coal consumption has risen by almost 60 percent and has come increasingly from abundant coal reserves in Montana, Wyoming, and North Dakota. However, continued increases in the use of coal may be limited by its environmental, economic and social costs. These possible limitations include reclamation of strip mined areas, use of scarce water resources, air pollution, and coal traffic.

Electricity is a form of energy which can be generated from oil, gas, coal, nuclear fuel, or other energy sources. In Minnesota, coal and nuclear energy are the primary fuels for electrical generation. Minnesota is also a net importer of electricity from other states and Canada. In addition to traditional uses, electricity is being used increasingly to heat residences--especially in suburban and rural areas. Minnesota's

electric consumption continues to rise at higher annual rates than its total energy consumption. With increased consumption have come severe conflicts between energy demand and environmental quality and land use.

Renewable sources of energy include solar, wood, biomass, wind and hydro. These sources are found in Minnesota but currently do not contribute significantly to the state's energy supply. As traditional sources of fuel are not anticipated to meet the state's growing energy demands in the future, it is likely that high costs and short supplies will shift Minnesota to greater dependence on those renewable energy sources that are available within the state.

Conservation can be thought of as a source of energy since it reduces the amount of energy consumed for accomplishing a given task, thus making more energy available for other purposes which require it. During times of abundant and inexpensive energy supplies, energy efficiency was only a minor consideration in homes, other buildings, industrial processes, and transportation. Now it is evident that substantial energy savings can result from conservation efforts in these major end use categories.

District heating can be an extremely efficient method of supplying space and water heating energy to residences and office buildings in highly developed areas. The highest efficiency is achieved when waste heat from electric generating plants is used to warm water for distribution to nearby buildings. Studies are under way to determine the economic feasibility of using this type of district heating in the Twin Cities Metropolitan Area.

Impact on Poor

Until very recent times, the cost of energy to American consumers represented only an insignificant fraction of disposable family income. Virtually no homes were without heat for reasons of inability to pay fuel

or utility bills. The gasoline mileage of automobiles was of minor concern to most purchasers. Commercial establishments, building designers, and industries were virtually heedless of energy consumption. America was glutted with oil and gasoline and electricity was "penny cheap."

The days of abundant, cheap energy are fast fading. New reserves of crude oil and natural gas are much more difficult and expensive to locate and develop. The world market price of crude oil has increased by a factor of four in six years. Consumers are being hit with rapidly rising costs for transportation fuel, electricity, and home heating energy. Energy experts hold out little hope for the discovery of traditional energy reserves or new energy technology of sufficient magnitude to significantly alter recent energy cost trends.

Hardest hit by skyrocketing energy costs are those persons on low or fixed incomes. The costs of providing the energy needed in a home has increased several fold since 1973 and now constitutes one of the largest single expenses for many homeowners. Utilities have experienced growing difficulties with past due accounts and utility service cut-offs have increased. Social welfare agencies are frequently called on to assist low income persons with energy payments.

Unfortunately, the rise in energy prices is expected to continue into the foreseeable future. The Minnesota Energy Agency anticipates that natural gas prices will increase at approximately 4.7 percent per year (real cost growth, not including inflation) between now and 1983. Propane prices should increase at 3.3 percent and fuel oil at 2.1 percent. Prices for electricity are also expected to increase, but not at uniform rates across the state. With the apparently inevitable upward progression of energy costs, programs for conservation, district heating, and the development of alternative energy sources look increasingly attractive. Beyond attempts

to control the use of conventional energy to practical minimums, social programs for financial relief to the low and fixed income persons of Minnesota appear to be imperative.

B. Past Legislative Actions and Policy Statements

Minnesota's legislative actions relating to energy are summarized below. A more detailed account of relevant legislation is included in Appendix 2.

In response to growing concern over predicted fuel shortages, the Governor appointed the Citizens Task Force on Energy Policy under the Environmental Quality Council in October 1972. The Task Force was created to examine "energy production and consumption patterns in the state with the aim of developing specific recommendations for state policy and action." It issued a set of recommendations and a final report in November 1973.

In June 1973, the State Planning Agency agreed to include energy issues in its fiscal 1974 work program. The Agency funded the Minnesota Energy Project, which was undertaken by the All-University Council on Environmental Quality of the University of Minnesota. The project produced a series of nineteen reports on energy sources, flow patterns, and end uses in Minnesota.

The Arab embargo of oil and the dramatic increase in oil prices during the fall of 1973 prompted discussion of new energy policies. The Minnesota Legislature, finding in part that "energy planning, protection of environmental values, development of Minnesota energy sources, and conservation of energy require expanded authority and technical capability and a unified, coordinated response within state government," created the

Minnesota Energy Agency (MEA) as part of the executive branch. The Legislature also issued energy conservation directives to the Commissioner of Highways, the Commissioner of Administration, the Tax Study Commission, and public school districts.

The MEA was given broad responsibilities for energy conservation information, education and outreach programs, data gathering, supply and demand forecasting, policy development, research, and emergency planning. In addition, it was given regulatory responsibility for determining the need for large new energy facilities. The Legislative Commission on Energy was formed to assist with the establishment of the MEA and oversee its policies and programs. It was directed to assess the need for a permanent and independent energy agency and to make recommendations on future energy legislation. The Commission expired in June 1975.

During its 1976 Session, the Legislature amended the Minnesota Energy Act of 1974. The amendments, among other things, authorized the MEA to establish an energy conservation information center, required promulgation of energy conservation rules, required energy surveys of certain public buildings, provided for solar energy performance standards, and appropriated funds for alternative energy systems research appropriate to Minnesota and funds for infrared aerial thermographs.

In 1977 the Legislature extended the life of the MEA to 1983 and made it responsible for conducting a coal impact study, certain energy conservation measures, a comprehensive legislative proposal for solar energy use in Minnesota, and contracting for a research and demonstration project on agriculturally derived fuels.

During the 1978 Session legislation was passed relating to energy efficiency standards for residences; consumer protection measures applicable to insulation; property tax exemptions for home solar energy,

wind, and methane gas systems; encouraging solar installations; and studying the effects of energy conservation programs on the cost of low and moderate income rental housing. At the end of the 1978 Session, the House Select Committee on Energy was appointed to assist the House of Representatives in identifying critical energy issues that should be addressed in upcoming legislative sessions.

CHAPTER III

LEGISLATIVE RECOMMENDATIONS

This chapter contains brief descriptions of the 59 concepts recommended by the House Select Committee on Energy for legislative consideration and action. The Committee did not seek to prioritize the recommendations. Thus, the order in which they are presented here should be understood as a function of topical grouping rather than of prioritization.

The majority of the recommendations included in this chapter were first considered in one or more of the three subcommittees and then referred to the full committee for further action. A few of the recommendations, however, were developed by individual committee members and presented to the full committee for consideration without subcommittee action. Those in the latter category usually concerned topics that did not fit naturally into the assigned subject areas of any of the three subcommittees.

It will be noted that the recommendations are not always presented in a uniform style and structure. In several instances a certain amount of descriptive material is included as part of the recommendation or as a preface to the recommendation itself. The reasons for this lack of parallelism are several, the most significant being a diversity of concept, authorship and/or specific language amendments made to the recommendations

during considerations by the full committee. It was believed to be beyond the authority of the editors of this report to make substantial changes in wording after the recommendations had been passed by the full committee.

The recommendations in this chapter are grouped by topical area.

A. Recommendations - Renewable Energy and Conservation, General

Most of the recommendations in this section were considered and recommended first by the Subcommittee on Alternative Energy Systems.* The principal criteria by which concepts were evaluated for subcommittee approval can be stated as follows: the Legislature should encourage and promote those renewable energy sources that are available in Minnesota, are energy efficient, and are economically attractive. In several instances it was not possible to get assurances of the extent to which a proposed renewable energy system (RES) met the criteria, and in those instances further evaluation (sometimes in the form of a "study") was frequently recommended rather than action to stimulate the RES directly. Regardless of whether studies or direct actions were ultimately recommended, the Committee repeatedly expressed belief that greater use of renewable energy sources is beneficial, if not essential, to the economy of Minnesota and will reduce the negative impacts of present and future shortages of conventional fuels.

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* A number of the recommendations as originally passed contained references to "alternative energy systems." It was decided during the Committee's deliberations that the term "alternative" was open to a degree of misunderstanding (some experts use the term to describe evolving coal technology or nuclear power) and that the term "renewable energy systems" more accurately describes the sort of devices being considered by the Committee. Therefore, in this report the term "renewable" is substituted for "alternative" wherever feasible.

The first several recommendations deal in a general way with the stimulation or promotion of all types of RES's and the utilization of highly energy efficient construction techniques.

1. It is recommended that the Legislature create within the Minnesota Energy Agency an Energy Finance Board (EFB). The EFB would make loans to individuals and businesses for construction of economically feasible renewable energy systems, and for conservation projects. In order to make such loans, the EFB should be granted revenue bonding authority. In addition, the EFB should be granted authority to provide loan guarantees to lending institutions which loan funds to individuals and groups for the construction of renewable energy systems and for energy conservation projects. Systems that qualify for loans would include: active and passive solar systems; wood burning systems (including wood-fired electrical generating plants); hydro-electric retrofit projects; gasohol plants; earth sheltering systems; etc. No system would qualify for a loan unless it is deemed to be economically viable enough to repay the loan.

2. It is recommended that the Legislature instruct the Department of Economic Development to work to the maximum extent of its statutory authority to promote and support small business establishments involved primarily in the production, processing, or marketing of renewable energy fuels or equipment designed to utilize renewable energy sources.

3. It is recommended that the Legislature fund a study of the long-range impacts of developing renewable energy systems on jobs and the economy of Minnesota.

In full committee and subcommittee hearings several persons testified that financing for the purchase and installation of renewable energy systems was difficult to obtain--particularly for low and moderate income

homeowners. Recommendation Number 1 is intended to moderate this problem and make access to financing for RES's more available. Both the Housing Finance Agency and the Minnesota Energy Agency have indicated that a carefully designed program of this type would meet a large share of the perceived need and would not require a great deal of additional appropriation or greatly increase staffing needs of the affected agencies.

To meet the growing demand for renewable energy systems, particularly the added growth that would be expected from creation of the Energy Finance Board, a number of financially healthy, Minnesota-based firms are needed. These firms would be involved in the production, distribution, and installation of RES's or in processing and delivering fuel for RES's.

As noted in Recommendation Number 2, the Department of Economic Development has the structure and resources to encourage these businesses. The stimulation of Minnesota firms is especially important at this time for several reasons. 1) The types of enterprises considered here are generally labor-intensive, providing additional employment for the Minnesota labor force--with at least some of that employment in areas of the state where unemployment is high. 2) The establishment of such firms at a time when interest in renewable energy systems is growing nationwide could give Minnesota firms a competitive advantage over firms in other states of the North Central Region. 3) Encouraging Minnesota suppliers of RES equipment and fuel may help assure reasonable quality control (consumer protection) and reduce the drain of consumer dollars to out-of-state suppliers.

The Committee felt that even though some of the advantages of stimulating Minnesota RES industries are apparent, more information is needed to evaluate the actual economic and employment implications of various levels of development. Recommendation Number 3 therefore encourages such a study.

One obvious mechanism for encouraging both the production and consumption of RES devices is the state tax structure.

4. It is recommended that the Legislature (a) remove all state taxes which impede the utilization of renewable energy sources and (b) provide tax incentives for development of renewable energy systems by the following:

(a) All renewable energy systems should be exempted from property taxes.

(b) All materials used in renewable energy systems should be exempted from state sales taxes. This could be accomplished by means of a refundable credit on state income taxes equal to the amount of sales tax paid on materials used in renewable energy systems.

(c) An investment credit, similar to the pollution control credit, should be allowed to stimulate investment in renewable energy systems.

The changes in tax structure contained in Recommendation Number 4 would have an undetermined but probably substantial impact on the purchase and use of RES's. The Committee reasoned that property and sales taxes currently represent a disincentive to investment in RES's. To the extent that sales and property taxes currently reduce or preclude purchases of RES devices, removal of the taxes and subsequent investment in RES's should not result in significant net revenue losses to the state. An investment credit, unlike tax exemptions, would result in revenue losses in support of RES's. The amount of the loss would depend on the number and value of RES devices installed, and reasonable estimates for these two variables are not presently available and probably will become available only after some experience with the credit has been gained.

5. It is recommended that federal tax credits granted to Minnesota residents for energy conservation and renewable energy systems not be taxed by Minnesota as income.

The federal Energy Tax Act of 1978 contains provisions for 15 percent credits for home insulation and other energy-conserving components (up to $300) and credits of 30 percent for the first $2,000 and 20 percent for the next $8,000 of renewable energy source property. Under present Minnesota law, any federal credit of this type is taxable as Minnesota income. Taxing the federal credit reduces its intended stimulation of investment in conservation measures and renewable energy systems. The federal energy credit could be added to the list of income sources exempted from Minnesota taxation.

6. It is recommended that the Legislature enact a 20 percent tax credit, up to a maximum of $2,000 per unit, for the purchase price of renewable energy source property as defined in the federal Energy Tax Act of 1978.

7. It is recommended that the Legislature enact a ten percent tax credit up to a maximum of $200 per unit for the cost of insulation and other energy conserving components (as defined in the Energy Tax Act of 1978) to any residential structure built or substantially completed prior to 31 January 1976. The credit would be available for necessary materials and labor used to improve the energy efficiency of owner-occupied or rental properties. The credit would be granted for the tax year in which the expense is incurred, beginning with the effective date of this act.

In addition to energy tax credits granted by the federal government, the Committee felt that Minnesota's future energy shortfalls could be miti-

gated by further stimulation of renewable energy sources. Energy efficiency improvements in residences would result in additional energy savings.

The fiscal impact of Recommendations Number 6 and 7 is not known, but for every million dollars of foregone state revenue a minimum of 500 major renewable energy systems could be installed or 5,000 homes could be weatherized. The actual number of installations or weatherizations would probably be several times larger than the 500 and 5,000 because few projects would be expensive enough to qualify for the full allowed credit. Saving one-third of the fuel used in 10,000 weatherized homes would free up enough fuel to heat 3,400 homes indefinitely. Replacing two-thirds of the energy in 1,000 homes using RES's would heat 670 homes. Two million dollars of foregone state revenue ($1,000,000 in each program) would result in fuel cost savings to Minnesota consumers of approximately $3.25 million in the first year and additional amounts in successive years as energy costs continue to rise.

8. It is recommended, in order to encourage conservation and the commercialization of renewable energy systems, that a pilot Energy Extension Agent Program be started, with agents serving both rural counties and suburban and urban localities. The agents would be required to have a broad knowledge of the practical application of renewable energy systems and conservation practices, and would provide advice and information to interested persons or organizations. The energy extension agents would work with individuals, groups, businesses and local units of government on a one-to-one basis, or on a group basis, in much the same manner as agricultural extension agents work.

The Select Committee spent considerable time and effort investigating the availability of energy information to the general public. It

was observed that many members of the public do not feel that they have access to reliable, first-hand information on certain phases of energy-related questions. For example, where does a person considering the installation of a solar energy system go to receive objective information on the relative merits of the several styles of equipment available on the market? How does the consumer assure safe installation of a particular unit in his home or business?

In searching for an appropriate and reasonable-cost mechanism for distribution of energy information, the Committee determined that the agricultural extension agent program might serve as a useful model. Recommendation Number 8 therefore suggests a pilot program involving a limited number of energy extension agents distributed throughout the state.

9. It is recommended that the Legislature require that all future state buildings, whenever it appears economical considering the life cycle costs of the buildings, make maximum use of renewable energy systems such as active and passive solar, earth sheltering, etc., provided that such systems do not interfere with the intended function of the building. Plans for all buildings should be drawn up after consultation with the Minnesota Energy Agency (MEA) and final plans must be approved by the MEA prior to the start of construction. Local units of government and school districts also should be encouraged to submit building plans to the MEA for review and comment on potential integration of renewable energy systems.

10. It is recommended that the Legislature charge the Department of Administration, in consultation with the Minnesota Energy Agency, with conducting a study of existing state buildings to determine which buildings could be economically retrofitted with renewable energy systems. They

should report their findings, along with recommendations and cost estimates, to the Legislature.

Recommendations Number 9 and 10 relate to the state's responsibility to set a good example in energy conservation and the use of renewable energy sources. This can be most effectively done by assuring that architectural plans for all new state buildings make maximum use of energy-conserving design and technology. Also, a building energy efficiency review service could be made available to school districts and local units of government contemplating the construction or major remodeling of buildings.

To emphasize the state's commitment to renewable energy sources, existing state buildings would be evaluated for possible application of RES equipment. State investment in RES devices would stimulate the market for locally manufactured equipment and would help to acquaint Minnesota building officials with the proper application of RES's.

11. It is recommended that the Legislature fund a study, through the Minnesota Energy Agency, of the effects of zoning practices and building codes on the utilization of renewable energy systems. The MEA should report back to the Legislature with recommendations.

12. It is recommended that the Department of Administration, Building Code Division, in cooperation with the Minnesota Energy Agency, perform a study of the current State Building Code to determine if the minimum amount of glazing (windows) required for residences could be reduced without increased risks to health and safety.

13. It is recommended that the Department of Education, in cooperation with the Minnesota Energy Agency and the Building Code Division of the Department of Administration, design an educational course for building code inspectors on the proper installation and operation of wood burning

appliances and solar energy systems. All building inspectors would be required to take such a course, which should be financed by the state. Building code inspectors could inspect wood burning and solar units for individuals, upon request, for safety and proper installation. Only units which are certified as properly installed could receive the tax breaks recommended in Number 6 above. Insurors should be prevented from increasing rates for homeowners who use wood burning appliances that have been certified by a building inspector as being properly installed.

14. It is recommended that the state examinations for architects and engineers include questions showing that applicants for licensure have knowledge of energy efficient design, materials, and equipment including the use of passive solar technology. It also is recommended that the State Board of Architecture, Engineering, Land Surveying and Landscape Architecture establish a procedure for ensuring that currently licensed architects are knowledgeable about energy efficient design, materials, equipment and passive solar technology.

Recommendations Number 11 through 14 relate to ways in which state and local government actions and regulations may be used to impede or encourage the use of energy conserving technology and renewable energy sources. The objective of the Committee is to minimize all unnecessary or unreasonable restrictions on the installation and use of RES devices or energy conserving construction techniques such as earth sheltering. Two of the recommendations consist of studies to analyze current restrictions and the potential impacts of changing them. The other two recommendations attempt to assure adequate professional assistance for users of conservation technology and renewable energy sources.

15. It is recommended that the Legislature fund a study by the Minnesota Energy Agency to examine the costs and feasibility of establishing a rating system for classes of renewable energy systems. Such a rating system would make available to the public information on the cost effectiveness and energy efficiency of various brands and types of solar energy systems, wind energy systems, wood-fired heating/cooking appliances, and other renewable energy systems. The MEA study also would identify present sources of reliable rating information and their current utilization by the public.

Consumers of renewable energy systems, both in Minnesota and nationally, have virtually no objective assurance of the construction quality, safety, or performance characteristics of the RES devices they purchase. Establishing a state laboratory to do actual testing and evaluation of wood burners, solar collectors, wind generators, and alcohol stills appears to be prohibitively expensive. Some industry groups are taking initial steps to evaluate available RES devices or at least to establish guidelines for such an evaluation. The Committee feels that consumer protection and safety are of such importance that the Minnesota Energy Agency should monitor activities that are developing in this area and report periodically to the Legislature.

16. Small scale projects demonstrating the application of renewable energy systems are important vehicles for energy conservation, education and research. The federal government has given minimal support for such projects. It is recommended that the Legislature move more aggressively in this area, giving particular emphasis to energy demonstration projects specifically related to Minnesota's climate and natural resources.

(a) The funding level for renewable energy demonstration projects should be raised to $2 million per biennium. This appropriation should include funds for the evaluation of funded projects.

(b) The Legislature should give greater direction to the Minnesota Energy Agency concerning the type of demonstration projects to be funded. High priority should be given to demonstration projects involving wood, passive and active solar, earth sheltering, biomass utilization and flywheel storage. Medium priority should be given to projects involving gasohol and hydro-electric retrofit. Low priority should be given to products involving peat and wind. The state should continue to fund a variety of renewable energy demonstration projects so that different alternatives, appropriate to different parts of the state, are developed.

(c) The Minnesota Energy Agency should be given authority to actively solicit grant proposals for specific types of demonstration projects so that greater direction can be given to the demonstration project program.

(d) The Legislature should require that demonstration projects be dispersed geographically throughout the state to provide easy access to interested persons wherever they live.

(e) High priority should be given to projects conducted by small non-institutionally affiliated entrepreneurs, i.e., "backyard inventors."

Recommendation Number 16, dealing with the stimulation of all types of renewable energy sources gives greater legislative direction to the Minnesota Energy Agency in its awarding of appropriated grant monies.

This recommendation answers the criticism that too little R & D funds are being made available and that too often the funds are granted to large, established research institutions rather than to deserving back-yard inventors. Also, the Committee feels that to get maximum benefits from R & D grants the MEA should actively solicit proposals based on a prioritization of sources and systems rather than screening all types of proposals for those that show the most merit.

B. Recommendations - Renewable Energy, Solar

The six recommendations that follow are specifically intended to enhance the development of both active and passive solar energy systems.

17. It is recommended that the Legislature encourage the Minnesota Housing Finance Agency (MHFA) to increase its activities in the area of financing solar active and solar passive energy systems on residences eligible for construction or home improvement with grants and loans. Wherever feasible, solar energy systems should be included among energy conserving measures applied to all housing units subsidized by the MHFA. The Legislature should further appropriate funds to serve as security for MHFA financed loans for solar and renewable energy equipment used by eligible low and moderate income persons and families in their dwellings.

The Minnesota Housing Finance Agency currently has grant and loan programs to serve the housing needs of low and moderate income persons and families. These programs include guidelines that allow for the financing of HUD approved solar equipment. In practice, however, solar units are very rarely part of most construction or rehab projects for several reasons--most importantly the high initial cost of solar units that must be balanced with limited financial resources and other hosuing necessities that may have higher priority. Further, HUD standards for solar units

are not readily understood or even available to builders. The Committee feels that more emphasis on solar is warranted even when high first costs are considered. It appears possible that if the state provided adequate security for the solar portion of rehab loans, the requirement that solar units meet HUD standards could be waived.

18. It is recommended that the Legislature develop and codify definitions for active solar energy systems and passive solar energy systems.

As the use of solar energy equipment becomes more widespread, and as the Minnesota Legislature continues to pass incentives for the installation and use of solar energy equipment, it has become apparent that the term "solar energy" needs more precise statutory definition. As an example of problems with the current definition, Minnesota Laws 1978, Chapter 786, Section 11 exempted from taxable valuation increase those pieces of real and personal property which serve a building with energy from solar, wind, or methane gas energy systems. The question has been raised as to whether passive solar energy devices (south-facing windows, increased thermal mass within a building) should qualify for the exemption. A more complete definition of terms used to describe solar energy equipment and other renewable energy systems would alleviate most of these problems.

19. It is recommended that the Legislature instruct the Department of Administration to amend the state building code to urge that all new single family residences and duplexes be constructed in a manner permitting the installation of solar active energy systems, including but not limited to a roof pitch and directional alignment suitable for retrofitting with solar energy collecting devices. It is further recommended that local zoning ordinances be considered which would encourage construction tech-

niques and building designs that permit retrofit with solar active energy systems.

Recommendation Number 19 encourages permissive language to assure that the future addition of solar energy systems would be possible at lowest cost to consumers of new housing.

20. It is recommended that the Legislature consider a sun rights nuisance clause allowing an action to be brought, similar to the clause deleted from the 1978 solar portion of the Omnibus Energy Bill.

The Minnesota Legislature has recently enacted measures to provide assurances that solar collectors will have continuing access to direct sunshine. One omission from existing law is a statutory declaration that denial of solar access is an infringement of property rights and may constitute a nuisance. As suggested for, but deleted from the 1978 energy bill, the user of a solar energy collector would be protected from loss of sunshine by the activities of neighboring landowners such as the construction of structures or the planting or growth of trees or shrubs.

21. It is recommended that the Legislature direct the Minnesota Energy Agency to expand its development and distribution of information on the benefits and technology of passive solar energy systems. Information suitable for builders, designers, and building code inspectors, and information of a less technical nature suitable for distribution to the general public should be prepared.

There is growing evidence that passive solar energy technology can result in large savings of conventional energy sources and is highly cost-effective. Members of the general public, and to some extent design professionals, are poorly informed about the technology and benefits of passive solar energy. The Committee feels that the Minnesota Energy Agency should

give greater emphasis to educating all Minnesotans about passive solar energy.

22. It is recommended that the plumbing system in new single family residences be required to include fittings to facilitate the future hook-up of a solar water heating system.

Florida has had several years of experience with a law mandating that new homes be fitted with a pipe connection to facilitate the future hook-up of solar water heating equipment. Florida's experience has shown that adding the fitting during construction costs only a very few dollars. Adding the fitting after construction necessitates draining the plumbing, cutting into existing pipework, and installing the fitting--typically at a cost of approximately $50.00.

Requiring a solar water heater hook-up fitting at the time of construction would remove one of the expenses and disincentives involved in solar retrofit projects.

C. Recommendations - Renewable Energy, Wood

The following seven recommendations deal specifically with wood and timber as renewable energy sources.

23. It is recommended that the Legislature conduct a study of state-owned heating plants which could be economically converted to the burning of wood and finance such conversions.

24. The technology and economic feasibility of small-scale wood fired generating facilities appears to exist. It is recommended that the Legislature establish and fund a task force made up of individuals from the Minnesota Energy Agency, the Department of Economic Development, and the Department of Natural Resources to research the feasibility of a small- to medium-sized wood fired electrical generating plant. The task

force should make recommendations to the Legislature on: the advisability of such a plant or plants; best location of such plants; control and ownership of such plants; financing strategies for such plants; the sale of electricity from such plants; the existence of a long-term fuelwood supply; potential environmental effects of such plants; the timber leases and other miscellaneous issues surrounding the establishment of such a plant. Consideration should be given in the study to the use of district heating in connection with electrical generation.

The Committee heard testimony indicating that many of Minnesota's forest areas are under-utilized and poorly managed. A great amount of fuelwood that is currently wasted could be harvested from these forest areas without causing significant damage to the soil quality or fertility. Furthermore, selective harvest of fuelwood would increase growth rates and the quality of timber from the forests. Fuelwood harvesting is labor intensive and would provide employment in some of the most economically depressed portions of the state.

Unfortunately, long distance transportation of fuelwood is costly and inefficient. Therefore, a wood fired boiler must be relatively close to a dependable fuel supply. Recommendations Number 23 and 24 seek to analyze the practicality of using fuelwood for heating certain state-owned institutions and for small-scale electric generating plants.

25. It is recommended that any municipality or group of municipalities operating a program for diseased tree removal be encouraged to make available to members of the general public any and all tree material that may be useful as firewood. The municipality shall establish appropriate procedures to be followed by the public when engaged in the collection of firewood. These procedures shall include consideration of

personal safety factors and the necessity to limit the spread of tree diseases. The Minnesota Energy Agency shall develop suggested guidelines for municipal programs to offer firewood to members of the general public.

26. It is recommended that the Legislature prevent any municipality from restricting fuelwood storage unless such storage would present a disease or sanitation problem.

27. It is recommended that when any regulated public utility, any agency or department of the state of Minnesota, or any local unit of government cuts wood usable as firewood, members of the general public be given an opportunity to harvest the firewood for personal use. The MEA would promulgate appropriate rules for offering firewood to the public.

These three recommendations are designed to make the use of firewood more practical and economical for the people of Minnesota. Together they would remove existing disincentives and would reduce the current waste of a valuable energy source.

28. It is recommended that the Legislature strongly promote forestation of plains areas in Minnesota and explore the possibility of transplanting trees from densely forested areas to sparsely forested areas of the state.

29. It is recommended that the Legislature encourage, by action of the appropriate standing committees, the planting and management of windbreaks to reduce energy loss from buildings.

In many parts of Minnesota, particularly the agricultural areas of the south and west, the acreage of forest land has been declining steadily over the past several decades. In an effort to increase both fuelwood availability and the energy conserving effects of windbreaks,

the Committee recommends planning for and implementing a reforestation program.

D. Recommendation - Conservation, Energy Audits of Public Buildings

The following recommendation attempts to address some concerns with the energy efficiency audit procedures created in 1976.

30. It is recommended that the Legislature redefine the term "survey" in the Statutes so that it is broadened to conform to the pluralistic meanings of audit. The public building audit program should be structured in such a way that all schools and local governments would complete the inexpensive "building energy report" and would then do a mini-audit or a maxi-audit only if the building energy report indicated a need to pinpoint opportunities for energy savings. This change would result in great financial savings to schools and local governments which, under current interpretation of the law, are required to perform maxi-audits on all buildings.

The 1976 Legislature passed an act requiring that most buildings owned and operated by school districts, the University, and local, county, and state governments be "surveyed" by the end of 1979 to determine their energy efficiency and the potential energy and cost savings that could be expected from improvements in efficiency. The vague meaning of the term "survey" has led to differing interpretations of the requirements under the act. The Building Code Division of the Department of Administration, in consultation with the Minnesota Energy Agency, has interpreted "survey" to mean an engineering study conducted by professional engineers, concentrating largely on the building envelope but also including analysis of various heating, cooling, and mechanical systems in the building. An expensive study of this type clearly was not

envisioned by the 1976 Legislature, as evidenced by its authorization of local or state building inspectors (who are rarely licensed as professional engineers) to perform the "surveys." School districts and local governments have complained about the expense of the surveys and have questioned their value. This situation has been further complicated by the new federal National Energy Act. The federal act offers some funds for the performance of certain types of energy efficiency evaluations on schools, hospitals, and local government buildings. At present, it is unknown what the impact of these programs will be.

In hindsight, it appears that the term "survey" should not have been used in the 1976 act. The term in general use by energy, architectual, and engineering professionals to describe evaluations of energy efficiency is "audits." There are several levels of audit, beginning with a straight forward computer analysis (building energy report) of a building and its use patterns, utility bills, and structural characteristics. The simple and inexpensive building energy report provides a valuable tool for determining which buildings are operating least efficiently and therefore deserve priority for conservation measures. A higher level of audit (the mini-audit) consists of a small team of experts walking through a building to observe lighting, heating, mechanical, and structural systems. Opportunities for low- and no-cost conservation measures are identified in this audit. The most sophisticated and costly form of audit (the maxi-audit) is the full engineering study performed by engineering and architectural professionals with the goal of identifying all energy conservation measures, including structural and system changes in the building.

E. Recommendations - Renewable Energy, Other Sources (Methane, Hydro Power, Gasohol, Wind)

The following recommendations deal with several renewable energy sources of potential value to Minnesota.

31. It is recommended that the Legislature appropriate from the general fund to the Minnesota Energy Agency for the biennium beginning 1 July 1979, the sum of $60,000 to conduct an analysis of the potential for methane production from urban solid waste, sewage sludge and diseased wood, insofar as similar studies are not being carried out by the federal government or other states. In the event that such studies are identified, the MEA shall monitor or cooperate in those parallel studies.

32. It is recommended that the Legislature fund a thorough inventory and assessment of the energy and economic potential of existing dam sites in Minnesota. It is further recommended that the Minnesota Energy Agency be instructed to study and monitor new developments in the technology of hydroelectric generation and hydromechanical power utilization, particularly those involving small scale and low head applications.

33. It is recommended that the Legislature give ongoing consideration to the economic and energy feasibility of producing and using gasohol in Minnesota. It is also recommended that the state investigate the possibility of implementing a gasohol demonstration project in Minnesota.

34. It is recommended that the Legislature explore the potential use of existing facilities capable of the manufacturing of alcohol (e.g., sugar beet processing plants and distilleries) for the production of gasohol.

35. It is recommended that the Legislature assess the potential of wind as an energy source for Minnesota.

Recommendations Number 31 through 35 deal generally with several emerging or re-emerging energy sources that may prove beneficial to Minnesota. In each case the Committee determined from testimony presented at hearings that the possible energy sources warranted further study to determine their potential technical and economic feasibility in Minnesota.

Small-scale hydro-power and wind-power were once significant contributers to Minnesota's energy mix. The widespread availability and low cost of fossil fuels has almost totally displaced these sources over the last three or four decades; but their potential still exists, and as fossil fuels become scarce and prices rise, increasing interest will be paid to them. While their total contribution will probably never be great, any substitution of a renewable energy source for an increasingly costly traditional source will be welcomed.

Gasohol is a registered tradename identifying a blend of 90 percent unleaded gasoline and 10 percent grain alcohol. It can be substituted for gasoline in motor vehicles without apparent problems and is reported to improve fuel mileage slightly while lowering some exhaust pollutants. The alcohol component of gasohol can be distilled from a number of resources available in Minnesota and could reduce our dependence on imported fuels. At present, gasohol is not cost competitive with gasoline because its advantages in fuel mileage are not quite sufficient to overcome the higher cost of the alcohol used in the blend. The situation may change as the technology of alcohol distillation improves and petroleum prices rise.

Methane gas is produced during the anaerobic degradation of organic wastes. Only recently has this phenomenon been applied to the creation of an energy source--methane gas can be substituted for natural or LP gas for many purposes. Urban solid wastes, sewage sludge, diseased wood

and other organic refuse could become a partial solution to energy shortages in Minnesota.

F. Recommendations - Emergency Energy Assistance

Concerns about the effect of rising fuel bills on low and fixed income persons were expressed frequently during the Committee and Subcommittee hearings. The following recommendations provide financial help for those who need assistance, yet do not discourage conservation efforts.

36. It is recommended that the Legislature amend Chapter 290A (Circuit Breaker) by adding provisions for an income-adjusted credit for the cost of heating fuels. The fuel credit would be refunded in one annual lump sum as an addition to the income-adjusted homestead credit.

37. It is recommended that as an early priority in the 1979 Session the Legislature determine the scope and impact of any existing federal fuel assistance programs. The Legislature then should design a state-funded program to supplement and/or broaden federal programs to assure that Minnesota citizens are not denied heating fuel because of a legitimate inability to pay for the fuel. The guidelines for any such assistance programs should not contain disincentives to the weatherization of residences affected by the assistance programs.

38. It is recommended that the Legislature establish an on-going program of fuel cost assistance to aid low and fixed income persons and families. Such a program should contain some or all of the following features: statewide availability covering all fuels; a residency requirement (in a given housing unit) of not more than three months; energy assistance payments to be made monthly throughout the winter months; and needy state residents should qualify regardless of eligibility for other

public assistance programs. The guidelines for such a fuel assistance program should not contain disincentives to the weatherization of residences affected by the assistance program.

The Select Committee, and especially the Subcommittee on Energy Cost and Pricing, heard extensive testimony about the severe financial burden rising energy prices are placing on low and moderate income persons. The need for immediate financial relief for those who are unable to pay energy bills became very apparent. One mechanism frequently suggested for assisting low and fixed income persons with their financial difficulties was the "lifeline" concept. Lifeline utility rates are based on the premise that a certain minimum quantity of energy--the amount needed to meet the basic life necessities of heating, lighting, cooking, and refrigeration--be provided to all customers at a very low, subsidized, cost. The subsidy to low energy users would be made up either from higher rates to large users within the class or from the industrial/commercial rate class. The Committee became convinced that not all low income utility customers are low energy users. Older, larger homes; larger families; and more time spent at home often result in high energy usage by low income persons. People in these circumstances would be penalized by a lifeline plan. On the other hand, many relatively wealthy apartment dwelling customers who spend little time at home, and eat and entertain "out," would qualify for the lifeline rate break. For these reasons the Committee does not recommend lifeline rates.

Recommendations Number 36 through 38 attempt to identify workable mechanisms for targeting energy cost relief to those persons most in need of it. Care must be taken to prevent rate relief programs from providing an incentive for non-payment of utility bills or a disincentive to reasonable conservation measures. The Committee believes these concerns can be met.

G. Recommendations - Utilities and Utility Regulation

39. It is recommended that the Public Service Commission be required to report to the Legislature by 15 March of each year on the utility rate cases during the previous calendar year in which the final Commission order differed significantly from the recommendations of the Public Hearing Examiner. The report shall include reasons for differences between the Examiner's recommendations and the Commissioner's final order.

The Committee noted that in several recent utility rate decisions the Public Service Commission has issued decisions that deviated substantially from the recommendations of the State Hearing Examiner. The Commission clearly has full authority to make such decisions and orders, but the Committee feels that the Legislature would like to be made aware of the Commission's reasoning when major departures are made from the Hearing Examiner's report.

40. It is recommended that the appropriate standing committee or committees of the 1979 Session look into some apparently serious problems with the organization and operation of the Public Service Commission and the Department of Public Service. Realizing that the Legislative Audit Commission (LAC) is currently involved in a program evaluation of the Commission and Department, the suggested legislative investigation could, in part, focus on following up recommendations of the LAC report. Consideration should also be given to providing permanent, independent staffing for the Public Service Commission rather than continuing the shared staffing arrangement that presently exists.

The Legislature has established a Public Service Commission and granted it broad authorities including the charge to make quasi-judicial decisions relating to the rates and service standards of public utilities.

The Department of Public Service handles the ongoing administrative aspects of regulating utilities, warehouses, weights and measures, and other areas of assigned responsibility.

The Commission is not provided independent professional staff, so when a utility rate proceeding is heard the Commission must rely on staff members supplied by the Department. The Select Committee has become aware that the shared staffing arrangement is one of several points of discord between the Department and Commission.

For continued effective and efficient operation of the Department and Commission, some organizational difficulties need to be resolved. The Select Committee lacked the time and resources to fully investigate the situation, but it is felt that the 1979 Session of the Legislature should do so.

41. It is recommended that the Legislature direct the Public Service Commission to forward to the Board of Residential Utility Consumers (BRUC), Consumer Services Section, Department of Commerce, a copy of all fuel cost adjustment filings. The BRUC will review all filings and seek Commission action if costs and expenses included in an adjustment appear to be unjustified.

"Automatic fuel cost adjustments" allow a regulated gas or electric utility to pass on to customers any changes in fuel costs. This pass-through avoids the cost and inconvenience of frequent rate cases while protecting the utility from financial chaos when suppliers of fuel raise their prices. Customers also get immediate benefit from any fuel cost reductions by a utility's suppliers.

Recommendation Number 41 is designed to protect the consumer from the inclusion of unjustified expenses in automatic adjustments. It sug-

gests that the Board of Residential Utility Consumers review all automatic fuel cost adjustment filings. Under Minnesota Statutes, Chapter 45, the Board is responsible for assuring that the residential consumers' concerns are presented effectively before the Public Service Commission.

42. It is recommended that the Legislature prohibit termination of residential utility service or fuel oil or LP gas deliveries during winter months. This prohibition would be contingent upon minimum monthly "good faith" payments by the consumer to the supplier as determined by Public Service Commission rule. Such a proposal should include consideration of the following major items: (a) Should be designed in such a way that it meets the needs of those persons and families for whom it is intended; (b) Should not provide consumers with an incentive for neglecting fuel bills that could otherwise be paid; (c) Should not cause an increase in rates of customers who pay promptly to cover the expenses of a larger number for late or uncollectable accounts; and (d) Should not cause utility revenues to deteriorate to the extent that bond ratings fall.

The Public Service Commission recently issued a temporary emergency order to all regulated utilities prohibiting the termination of utility service during the winter months of 1978-79 for non-payment of bills. The Committee recognizes this is a first step in preserving life and safety but feels that the concept should receive more thorough study and be given permanent status by the Legislature.

43. It is recommended that Construction Work in Progress (CWIP) not be included in the rate base of regulated utilities.

Utility companies are currently not permitted to include the costs of constructing new facilities in their customer rate base until the

facilities become operational. Therefore, on the date when a new facility begins operating, and during the expected operating life of the facility, customers pay for all interest costs during construction as well as the facility itself and fuel, operating, and maintenance costs.

It has been proposed that utilities be allowed to include some or all of the Construction Work in Progress (CWIP) costs in their rate base. Rates would go up sooner, yet more gradually, if CWIP were allowed in the rate base. However, customers who discontinue utility service in the area would be financing a facility from which they could expect to receive no benefits. Future customers would not contribute an equitable share of the costs. Furthermore, including CWIP in the rate base might give utilities an incentive for premature expansion of facilities. The Committee therefore decided that CWIP should not be part of the rate base.

44. It is recommended that all charitable contributions made by a regulated utility be excluded from the rate base.

In the past, regulated utilities have been allowed to include in their rate base an amount equal to the charitable contributions made by the utility. As a result, the utility's customers financed the utility's contributions without the privilege of determining the beneficiaries. The 1977 Legislature prohibited the inclusion of more than 50 percent of a utility's contributions in its rate base. In all major rate cases since that legislation, the Public Service Commission has denied the inclusion of any charitable contributions. Recommendation Number 44 would establish a consistent policy concerning the inclusion of charitable contributions in the rate base--none would be allowed.

45. It is recommended that the Legislature continue to allow rates under bond but require that all refunds for overcharges (collected under bond) be made to consumers before the utility can file a subsequent rate increase request.

46. It is recommended that the Legislature amend current statutes to require that the Public Service Commission prepare guidelines or a formula for the preliminary refund to rate payers of overcharges collected under bond. At the time of the Commission's Decision and Order (not more than 12 months after the rate request filing), the utility would make customer refunds based on the guidelines or formula. If there were rehearings or appeals, a portion of the rates originally requested by the utility would continue to be collected under bond even though the initial refund procedure was activated. When the ultimate decision and rate schedule are determined, the Commission would order refund of the additional (beyond the first 12 months) excess revenues collected under bond.

Under present statutes and regulations, when a regulated utility finds it necessary to change its customer rates, it files a rate request with the Public Service Commission. Ninety days after the filing, the utility begins to charge the new rates if the Commission is satisfied with security arrangements for safeguarding the additional rates being collected. Not more than twelve months after the filing, the Commission must determine how much of the rate request is justified and will be allowed. Any excess rates must be refunded to the customers with interest.

The Commission and the utility have not always cooperated in such a way that consumers could receive their refunds within a reasonable time. In one situation, a utility filed a second rate increase request before refunds from the previous filing had been made to customers. Recommendations Number 45 and 46 attempt to prevent this situation in the future

and minimize financial hardships on the consumers.

47. It is recommended that the Public Service Commission be allowed to continue its present practice of ordering refund procedures based on consideration of the accounting capabilities of the individual utility.

When the Public Service Commission orders a utility to make refunds to its customers, the Commission determines what refund procedure the utility will use. In making this determination, the Commission considers the accounting capabilities of the utility. Presently only one Minnesota utility has the capability for calculating refunds on a detailed, individual customer basis. The other utilities use estimation techniques approved by the Commission. For those utilities, calculating precise refunds for each customer would be so costly that the expense would eliminate most of the refund. Even at the risk of possible minor inaccuracies in refunds for some customers, the Select Committee suggests that the Commission continue its current procedures in ordering refunds.

48. It is recommended that the appropriate committees of the Legislature monitor current Public Service Commission studies to determine how utilities and customers would be affected by optional rate schemes. In addition the Legislature should direct the Commission to require that selected utilities offer optional rate schemes (including time-of-day metering, peak load pricing, and dual metering) to a certain number of customers in each user class. The schemes would be offered on an experimental basis to determine actual customer response and the cost impacts for both the utility and the customer.

Gas and electric utilities supply customers with energy forms that cannot be stored easily by the customers. Therefore, the energy must be delivered exactly when it is used by customers. Utilities are required

to provide generating and delivery capacity sufficient to meet the greatest demand customers may place on the system at any one time. This "peak demand" occurs only at certain brief times of the year. Most Minnesota electric utility systems experience their peak annual demand during the hottest afternoon of the summer when air conditioners strain to keep residences and commercial buildings cool. A second heavy usage period occurs during the coldest winter days. Because natural gas is now used primarily for residential and commercial space heating, the natural gas utilities experience peak annual demands early in the morning of the coldest day of each winter. Utilities also experience daily peak use periods caused by fairly predictable residential and commercial demand patterns.

Since peak demand occurs only during limited times of the year, utilities end up building and maintaining facilities which operate far below capacity during much of the year. Any reduction in peak demand could result in a more cost efficient system which would require fewer and/or smaller new facilities. Currently some utilities are offering their customers optional pricing schemes which encourage off peak energy use and thus reduce annual or daily peak loads. Testimony at several public hearings indicated that customers who are being offered optional pricing schemes are eagerly accepting them and that the economic impact has been good for both the utility and the customer.

Three somewhat related alternative pricing schemes are time-of-day metering, peak load pricing, and dual metering. All attempt to level out daily and annual demand while reducing peaks. With time-of-day metering, different rates are charged according to the time of day in which the electricity or gas is used. The rates are higher during hours when the utility generally operates at or near its peak capacity. A clock on the

meter determines whether the higher or lower rate will be charged. Peak load pricing requires more sophisticated metering equipment than time-of-day metering to charge higher rates for those times when the utility actually does operate at peak capacity (e.g., unusually hot or cold days). With true peak load pricing arrangements, the utility sends out a signal to tell the meter which rate to charge. With dual metering, each customer has two meters. One meter is switched on or off by the utility while the second meter operates at all times. The customer's heavy electrical loads that can be interrupted are connected to the first meter. The customer must make provisions for alternate energy during times when the first meter is switched off. A much lower rate is charged for hours registered on the meter controlled by the utility.

The Public Service Commission currently is using computer models and surveys to study the effects of optional schemes on customers and utilities. In addition to these studies, there is a need for information on the actual response of customers in different user classes to optional pricing schemes. It must be recognized that schemes which are appropriate for some utility systems and in some parts of the state may be totally unworkable in other service areas. Therefore, experiments with optional rate schemes should be tried on customers in dispersed areas of the state.

49. It is recommended that the Public Service Commission allow rate structures within the residential class which encourage effective load management.

Currently, almost all residential electric rates provide no penalty or reward for effective electrical load management. Effective load management consists primarily of reducing electricity use during the peak demand

hours by switching off high energy using equipment that could be operated at off-peak times. Load management tends to keep energy consumption as uniform as possible through time. Voluntary load management is possible in the residential sector and might be attractive to many customers if an incentive for its use existed.

50. It is recommended that all utility customers be assessed a periodic customer or service charge. The service charge is intended to cover a portion of the costs incurred by the utility for customer metering equipment, meter reading, billing and record keeping. The amount of the charge should be clearly and fully disclosed on each customer billing statement.

At a number of Committee hearings, complaints were expressed about the periodic service charge billed to utility customers. Some people felt that the charge should be eliminated or that further justification should be required. The Committee recognized that oil and LP gas customers are not assessed a service charge. However, utility customers avoid many of the expenses associated with the use of storable fuels such as oil and LP gas. Oil and LP gas customers must usually pay for their energy supplies at the time of delivery or shortly thereafter. Utility customers are billed for electricity and natural gas only after the fuel has been consumed and the meter read. Oil and LP gas customers often must purchase or lease the tanks in which the fuel is stored. Utility customers make no such purchase. The service charge which utility customers must pay actually represents only a modest portion of the true cost of supplying the metering equipment, billing systems, and associated services. It therefore is reasonable and should be retained.

51. It is recommended that the Public Service Commission approve all procedures by which utilities estimate customer energy usage. The number of consecutive months in which estimating is allowed should be limited.

Utility companies read customers' meters on a periodic basis. During the months between meter readings, customers are billed for an estimated level of energy usage. This practice reduces the high costs of making monthly meter readings for every customer. However, estimated billing does make customers vulnerable to overcharges due to overestimated electrical or natural gas usage. For this reason, estimated billings should be regulated carefully.

52. Current rate structures may act as a disincentive to the use of renewable energy systems. Widespread use of renewable energy systems could have an important impact on utility companies. It is recommended that the Legislature fund a study, through the Minnesota Energy Agency, of the potential impacts of the widespread use of renewable energy systems on utilities and utility rate structures.

With the increasing use of renewable energy systems, it is important to seek solutions to potential problems between RES's and utilities. These problems may adversely affect both the person with RES equipment and the utilities. Rate structures which charge lower prices for high consumption may discriminate against customers with RES's who use only small amounts of utility power. On the other hand, RES's may greatly aggravate the utilities' problems with peak demand. The customer who uses utility power to augment his RES only during peak times (e.g., very cold weather) makes a very small regular payment to the utility. Yet the utility must build and maintain sufficient generating and distribution capacity to supply ample energy to that customer if, during peak times, the RES equipment is

not operating. This utility peakload problem could be alleviated if customers used a storable fuel (e.g., propane, oil, coal, wood) rather than utility power to augment their RES's.

H. Recommendations - Miscellaneous

53. It is recommended that the Legislature clearly define powers and procedures to be used in the event of an energy supply emergency as defined in Minn.Stat. §116H.09.

Under present law, an energy supply emergency may be called by either the Executive Council or the Legislature. Beyond the point of declaring an energy emergency, there is little statutory authority vested in any of the various persons, departments, and organizations that carry out the actions necessary to alleviate problems from the energy emergency. Lines of authority are not well defined and the possibility exists for serious breakdowns in communication and weakness in enforcement.

54. It is recommended that the Legislature appropriate required matching funds for the completion of Minnesota Energy Agency studies to determine the feasibility of large scale hot water district heating in the metropolitan area.

During the conversion of coal, nuclear fuels, and other fuels into electricity, two thirds of the energy in the fuel is lost in the form of waste heat. Much of this waste heat can become useful heat by combining electrical generation with district heating. District heating is the use of a central energy conversion facility to produce steam or hot water that is distributed to end use points such as homes and businesses.

Parts of both Minneapolis and St. Paul presently are served by operational district heating systems. In the case of St. Paul, the Third Street Steam Plant is approaching the end of its useful lifetime and lacks the efficiencies possible with new hot water district heating systems. As noted, large energy savings can be realized if waste heat from the generation of electricity is utilized as the heat source for district heating. Federal funds are being channeled through the Minnesota Energy Agency for studies to determine the feasibility of large-scale hot water district heating in the Metropolitan Area. These studies deserve support from the Legislature.

55. It is recommended that the Legislature discourage the discontinuation of district heating utility operations until an engineering and financial study has shown that termination is the most appropriate action. In this respect, the Legislature should fund part or all of the cost for studies to evaluate options open to financially troubled district heating utilities. Further, it might be appropriate for the Legislature to cover part or all of the operating losses incurred by municipal district heating utilities during the first two years that feasibility studies are being performed.

Twelve Minnesota municipalities recently terminated operation of their district heating utilities--seven during the last three years. Often the cause of termination was a minor but continuing operating deficit. Several of the remaining eighteen municipalities with district heating appear to be contemplating discontinuation of their systems. Once these systems have been allowed to terminate service, it is very unlikely that they could be revived, in part because former customers would have made considerable investment in on-site heating systems.

Continued loss of district heating systems is highly undesirable for a number of reasons, including the following: (1) Customer conversion to on-site heating systems represents a financial impact many times larger than the annual operating deficit of the district heating system. (2) District heating may well prove to be far more energy efficient and less polluting than on-site heating. (3) Large, centralized boilers have more potential for conversion to alternative fuels (peat, wood wastes, garbage, etc.) than do individual home or business furnaces. On the other hand, municipalities cannot be expected to continue indefinitely operation of a utility that represents a continued revenue loss.

56. It is recommended that the Legislature support, through the University appropriation process, continued development of the University's district heating and power project (Grid-ICES).

The Minneapolis campus of the University of Minnesota is developing a grid connected integrated community energy system (Grid-ICES). The University's heating plant has been converted from gas/oil to coal. A retired Northern States Power generating plant, located adjacent to the heating plant, has been purchased and is being retrofitted. The combined facilities will permit the simultaneous generation of electricity and steam for heating. This type of cogeneration is reportedly 54 percent more efficient than the normal fossil fuel fired utility company generating plants. In the future, the University steam system may be extended to include St. Mary's and Fairview Hospitals and Augsburg College. Also, solid waste may be used as part of the system's fuel supply.

57. It is recommended that local units of government be precluded from prohibiting earth sheltered construction and be allowed to grant variances where feasible for earth sheltered homes. The Legislature

should fund a study of possible building code barriers to increased utilization of earth sheltering technology.

Numerous recent studies, plus a limited but growing amount of real-life experience, indicate that earth-sheltered housing and underground development are significant energy savers. Particularly in a cold state like Minnesota, the development and utilization of earth sheltering technology should be strongly encouraged. Present impedements to earth sheltering include a variety of institutional and some financial barriers. To a certain extent, some of the legal and institutional barriers could be eliminated by the Legislature in much the same way that certain institutional barriers to the use of solar energy were reduced by the 1978 Legislature.

58. It is recommended that the Minnesota Energy Agency monitor and support research into methods of utilizing coal in economical and environmentally satisfactory ways. The technologies that appear to be particularly well suited to the Minnesota situation because of coal source, air quality standards, etc., should receive highest priority.

Coal is the country's most abundant conventional energy resource. As the supply of oil and gas decreases and their price increases, coal is once again becoming an important energy source for Minnesota and the nation. The rising use of coal increases the need to alleviate problems associated with coal use, e.g., air and water pollution. New technologies must be developed for the cleaning and combustion of coal in order to mitigate adverse environmental impacts.

59. It is recommended that the Legislature fund a study of potential problems relating to the state's responsibility for decommissioning

nuclear power plants at the end of their productive lives. The study should identify strategies for decommissioning plants. In addition, the study should produce recommendations on who should pay the cost of decommissioning nuclear power plants and what role the state should play in assuring that proper financial planning is carried out to pay for decommissioning.

The average operating life of a nuclear plant is twenty to thirty years. With this lifespan, Minnesota's existing nuclear plants, all built in the early to mid 1970s, will be taken out of service sometime during the turn of the century. Decommissioning a nuclear plant is an expensive undertaking because of the radioactive contamination of the plant. Unless planning for decommissioning is made in advance, decommissioning may create financial and safety problems which the state is unprepared to handle. It therefore is important to know how the plants will be decommissioned, who will finance the decommissioning, and, before any additional plants are allowed, whether the decommissioning costs make nuclear fuel less economical than other sources of fuel.

A P P E N D I X 1

HOUSE SELECT COMMITTEE ON ENERGY

Members

Nelson, Ken (Minneapolis) Chairman

Stanton, Russell (Arco) Chairman: Alternative Energy Systems Subcommittee

Vanasek, Robert (New Prague) Chairman: Energy Cost and Pricing Subcommittee

Petrafeso, Pete (St. Louis Park) Chairman: Energy and Economic Development Subcommittee

Anderson, Delbert (Starbuck)

Battaglia, David (Two Harbors)

Braun, Art (Greenbush)

Clark, Janet (Minneapolis)

Corbid, John (Oklee)

Dean, William (Minneapolis)

Evans, Jim (Detroit Lakes)

Ewald, Douglas (Minnetonka)

Friedrich, Donald (Rochester)

Hanson, Walter (St. Paul)

Kahn, Phyllis (Minneapolis)

Kalis, Henry (Walters)

Kelly, William (East Grand Forks)

King, Dwayne (Golden Valley)

Lemke, Richard (Lake City)

Munger, Willard (Duluth)

Reding, Leo (Austin)

Simoneau, Wayne (Fridley)

Skoglund, Wesley (Minneapolis)

Wigley, Richard (Lake Crystal)

MEETINGS OF THE HOUSE SELECT COMMITTEE ON ENERGY

(See following pages for subcommittee meetings)

8 June - State Capitol

Energy and the economy; alternative sources of energy; energy costs and pricing.

14 June - State Capitol

National Conference of State Legislators Energy Policy Project; National Energy Act; history and purpose of Mid-American Solar Energy Complex.

10 July - State Capitol

Minnesota polls on energy issues; Minnesota's electric energy future; interests of low and moderate income people; weatherization, energy education, and demonstration programs; energy decision-making process.

15 August - State Capitol

Minnesota Coal Study; district heating.

14 September (Afternoon) - State Capitol

Energy education.

14 September (Evening) - State Capitol

Alternative energy sources; energy decision-making process; rail passenger service.

5 October - State Capitol

Energy conservation; coal transportation.

6 October - State Capitol

Nuclear energy debate; social dynamics of energy decisions.

1 December - State Capitol

Discussion and vote on recommendations.

8 December - State Capitol

Discussion and vote on recommendations.

14 December - State Capitol

Discussion and vote on recommendations.

MEETINGS OF THE ALTERNATIVE ENERGY SYSTEMS SUBCOMMITTEE

29 June - State Capitol

Minnesota Energy Agency's alternative energy activities and projects.

10 July - State Capitol

Passive solar design; solar energy systems.

25 July - State Capitol

Minnesota's peat resources.

26 July - State Capitol

Wind; wood; flywheels; hydro power.

31 July - Marshall

Energy from agricultural products; solar heated homes; weatherization and solar installation program for low-income persons; hydro power.

1 August - Mankato

Fairmont solid waste facility; production of ethyl alcohol; wind energy system; conversion of refuse into fuel.

2 August - Blue Earth

Blue Earth power plant steam heat system; large scale versus small scale power plants.

7 August - State Capitol

Methane digestion; wetland sources of energy.

8 August - State Capitol

Biomass conversion; urban solid waste.

15 August - State Capitol

Evaluation and ranking of alternative energy sources.

25 September - Detroit Lakes

Gasohol; Energy Systems Study; solar energy systems; wood heating.

26 September - Thief River Falls

Solar-assisted earth sheltered house.

29 November - State Capitol

Discussion and vote on recommendations.

6 December - State Capitol

Discussion and vote on recommendations.

MEETINGS OF THE ENERGY COST AND PRICING SUBCOMMITTEE

30 June - State Capitol

Housing Finance Agency's energy related programs; responsibilities of Department of Public Service and Public Service Commission; rate reform issues in the National Energy Act.

10 July - State Capitol

Federal and state energy assistance programs.

19 July - Minneapolis

Natural gas prices; utility rate structures; customer rights.

17 August - Duluth

Cost of utility service; fuel adjustment clause; termination of service.

22 September - State Capitol

Utility rate structures; fuel adjustment clause; termination procedures; master metering.

25 September - Detroit Lakes

Time-of-day pricing; declining block rates; lifeline rates; fuel adjustment clause; termination procedures.

26 September - Thief River Falls

Utility rate structures; termination procedures; reverse metering.

4 October - Northfield

Utility company policies; Public Service Commission; lifeline rates.

28 November - State Capitol

Discussion of recommendations.

MEETINGS OF THE ENERGY AND ECONOMIC DEVELOPMENT SUBCOMMITTEE

22 June - State Capitol

Business concerns about Minnesota's energy supply and prices.

27 July - State Capitol

Business concerns about energy policy, energy use and conservation.

APPENDIX 2

HISTORY OF STATE ENERGY ACTIVITIES

October, 1972 - Governor Anderson appointed the Citizens Task Force on Energy Policy under the Environmental Quality Council to examine "energy production and consumption patterns in the state with the aim of developing specific recommendations for State policy and action." The Task Force met 16 times and issued a set of recommendations and a final report in November 1973.

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June, 1973 - The State Planning Agency agreed to add the energy issue to its fiscal 1974 work program. The Agency then funded a project by the All-University Council on Environmental Quality (University of Minnesota) to study and report on energy sources, flow patterns, and uses in the state. The result of this project was a series of 19 reports on various aspects of energy use in Minnesota. Funding for the Minnesota Energy Project was terminated at the end of calendar year 1974.

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March 28, 1974 - Minnesota Laws 1974 Chapter 307 - Created the Minnesota Energy Agency to assure a unified coordinated response within state government to energy conservation, planning and development; and to assure statewide environmental protection consistent with an adequate, reliable supply of energy. The agency was established in the executive branch, with its director serving at the pleasure of the governor.

Duties of the new Energy Agency included:

1. establish a central repository within state government for energy data,
2. prepare an emergency conservation and allocation plan to be implemented in the event of an energy supply emergency,
3. make a continuing assessment of trends in energy consumption and analyze the social, economic and environmental consequences of these trends,
4. recommend and carry out energy conservation measures,
5. collect and analyze data on present and future energy needs and supplies,
6. require a certificate of need for construction of large energy facilities,
7. evaluate and make recommendations on energy pricing policies and rate schedules,
8. study the impact and relationship of state energy policies to regional, national and international energy policies,
9. design a state energy conservation program--commercial, industrial and residential,
10. inform and educate the public about energy conservation,
11. dispense funds for studies and projects in the area of energy conservation and alternative technologies,
12. charge other governmental departments involved in energy related activities with information gathering goals,
13. transmit to the Governor and the legislature a comprehensive biennial report on trends related to energy supply, demand, conservation, public health and safety factors, and the level of statewide and service area energy need.

Other energy conservation directives:

- the commissioner of highways shall promulgate regulations on energy use standards for street, highway and parking lot lighting.
- the director of the Energy Agency may investigate promotional practices by energy suppliers and may make regulations to limit such practices.

- After July 1, 1974 no new natural gas outdoor lighting shall be installed in the state.
- The commissioner of administration shall promulgate energy efficiency standards for building design and construction by April 1, 1975--these standards to become part of the state building code effective 6 months after promulgation.
- The energy Agency director and commissioner of administration may promulgate regulations to insure that energy use and conservation is considered in state purchases of supplies, automobiles and equipment.
- The commissioner of highways shall study the efficiency of the traffic flow system within the state.
- The commissioner of administration shall study the state telecommunication system to reduce travel between state departments.
- The Tax Study Commission shall study tax incentives to encourage car pooling and private busing.
- The Energy Agency director and the motor vehicle services division shall study the feasibility of modifying motor vehicle license fees to reflect energy consumption.

A Legislative Commission on Energy was formed to assist with the establishment of the Agency and to evaluate its policies and programs. The Commission was to assess the need for a permanent and independent energy agency, and to make recommendations on future energy legislation. The Commission expires July 1, 1975 unless renewed by the legislature.

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April 11, 1974 - Minnesota Laws 1974 Chapter 577 - Required public school districts to report annual energy use by fuel type, including fuel used for heating buildings and transporting students. Also required school districts to submit to the commissioner of education a "detailed plan" to reduce energy consumption during the 1974-75 school year.

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April 30, 1975 - Minnesota Laws 1975 Chapter 65 - Delayed the date by which the commissioner of administration must promulgate standards for energy efficiency of buildings from April 1, 1975 to August 1, 1975.

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May 17, 1975 - Minnesota Laws 1975 Chapter 170 - Amends definitions of large energy facilities and clarifies certificate of need procedure. It provides that no large energy facility be constructed or sited in the state after a certain date without issuance of a certificate of need.

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April 13, 1976 - Minnesota Laws 1976 Chapter 254 - Expands the Housing Finance Agency grant/loan program to include projects to improve energy efficiency in housing. Appropriates $6,000,000 to be used for energy grants/loans.

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April 19, 1976 - Minnesota Laws 1976 Chapter 333 - Amends the Minnesota Energy Act (1974). This legislation:

1. directed the energy agency to establish an energy conservation information center
2. banned the use of decorative gas lamps, effective April, 1977
3. required the energy agency director to report to the legislature on the economic and technological feasibility of energy conservation with respect to air conditioners and pilot lights

4. directed the commissioner of administration to promulgate energy efficiency standards for all public buildings and to survey all state-owned and University of Minnesota buildings to determine their potential for energy savings. Required local units of government and school districts to conduct similar energy conservation surveys.
5. directs the department of administration and the Energy Agency to draw up performance standards for solar energy systems, and requires that manufacturers and retailers of solar energy systems disclose the extent to which their system meets those standards.
6. provides for the monitoring and evaluation of research and demonstration projects of alternative energy systems being conducted in Minnesota as well as in other states and countries.
7. appropriates $200,000 to make grants for demonstration projects of alternative energy systems appropriate to Minnesota, and appropriates $50,000 to contract for infrared aerial thermographs.

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June 2, 1977 - Minnesota Laws 1977 Chapter 381 - Extends the life of the Minnesota Energy Agency to 1983 and adds the following responsibilities:

1. conduct a coal impact study in cooperation with several other state agencies
2. propose rules for limiting the use of outdoor display lighting
3. conduct a study of the heating fuel storage capacity of the state
4. develop energy conservation publicity
5. develop a comprehensive legislative proposal for solar energy use in Minnesota
6. promulgate economically feasible energy efficiency standards for existing residential buildings
7. contract with the University of Minnesota to carry out a research and demonstration project on agriculturally derived fuels.

This legislation also:

- extends the application of the state building code to all cities and counties
- bans the sale or installation of room air conditioners having an energy efficiency ratio under 7.0
- bans the sale or installation of natural gas furnaces, clothes dryers and cooking appliances with continuously burning pilot lights
- directs the department of education and the energy agency to prepare an interdisciplinary energy education program for schools.

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April 5, 1978 - Minnesota Laws 1978 Chapter 786 -

1. Expands sources of funds that the Minnesota Energy Agency may receive and expend
2. Requires that the Department of Administration promulgate energy efficiency standards for existing residences. (extends deadline by a year to January 1, 1979.)
3. Renter-occupied residences must comply with minimum energy standards (caulking and weatherstripping only) by January 1, 1980 and must comply with all cost-effective energy standards by July 1, 1983. MEA shall make random checks to insure compliance
4. After October 1, 1979 every seller of a residence must provide the buyer with a certified disclosure of compliance with energy standards unless the buyer waives his right to the disclosure. The Department of Administration will have trained and certified energy evaluators in each county

5. The MEA shall develop and enforce rules for the quality, safety, manufacture, labelling, advertising, and installation of insulation materials to protect consumers
6. The value of home solar energy, wind, and methane gas systems installed before January 1, 1984 shall not be included in the assessed market value of real property.
7. several zoning and subdivision development statutes are amended to encourage consideration of access to direct sunlight for property owners
8. Provision is made for the writing and recording of a solar easement; Minimum contents for the easement are specified.
9. Statewide application of the building code is delayed for six months to January 1, 1979, and uniform lumber grading is extended 18 months to January 1, 1980.
10. A total of $42,000 in new appropriations is made for promulgating rules required by this act. In addition, $80,000 is cancelled and reappropriated to the Housing Finance Agency to study the effects of energy conservation programs on the cost of low and moderate income rental housing.

APPENDIX 3

GLOSSARY OF ENERGY TERMS

A. MEASURING ENERGY

Energy comes in a number of forms, and a variety of terms are used to describe each. At first glance, it appears difficult, if not impossible, to compare one energy type with others and to comprehend their relationship. Fortunately, there exists a common denominator by which we can compare the energy content (heat value) of all energy forms. This unit of measurement is the British Thermal Unit (Btu).

One Btu is the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit. A common kitchen match relates approximately one Btu when completely burned. To heat one gallon of water (eight pounds) in a perfectly efficient water heater from 50 degrees F. to bath temperature (115 degrees F.) requires 520 Btu. Heating 20 gallons of bath water would require 10,400 Btu. Actually, most home water heaters are only about 65% efficient, so 16,000 Btu of fuel is required to supply the 10,400 Btu to heat the water for a 20 gallon bath.

In the metric system, the basic unit of energy measurement is the calorie which equals slightly less than 4 Btu. One calorie is the energy needed to raise the temperature of one kilogram of water by one degree Celsius.

The heat value of all fuels can be expressed in Btu's or calories. Some of the more common values are:

Fuel	Unit	Btu Content
Electricity	Kilowatt Hour	3,413
Crude Oil	Gallon	140,000
Crude Oil	Barrel (42 gallons)	5,880,000
#1 & #2 heating oil	Gallon	139,000
Residual Oil	Gallon	149,000
Liquified Petroleum Gas (LPG)	Gallon	95,500
Gasoline	Gallon	125,000
Natural Gas	Cubic Foot	1,000
Lignite Coal	Pound	7,500
Sub-bituminous Coal	Pound	8,500
Bituminous Coal	Pound	8,500 to 12,000
Anthrecite Coal	Pound	11,000 to 13,000
Firewood (air dry)	Pound	6,000 to 9,000
Firewood	Cord (4x4x8 ft)	20,000,000
Peat	Pound	6,500

B. ENERGY IN PERSPECTIVE

Space heating for a typical Minnesota home requires approximately 130,000,000 Btu per year, and water heating requires another 18,000,000 Btu.

Driving an automobile (15 miles per gallon) requires about 8,500 Btu per mile.

Burning a 100 watt lightbulb for one hour uses 341 Btu.

C. TERMS SPECIFIC TO ELECTRICITY

Alternating Current (AC) -- Electricity that is generated and distributed in such a way that the flow of electrons is reversed in a rapid, scheduled pattern. In the U.S., virtually all electricity sold by utilities is of the AC type and is regulated at 60 cycles per second, meaning that the flow of electrons changes from positive to negative 60 times each second. AC power has the advantage of simple and efficient conversion from one voltage to another by the use of a transformer. Alternating current can not be stored.

Direct Current (DC) -- Electricity that flows from one pole to the other without cycling as does AC. DC electricity can be stored in batteries but it can not be easily or efficiently adjusted from one voltage to another. Electrical accessories on motor vehicles operate on DC power, as do many wind-powered home generating systems.

Watt -- A measure of the rate at which electric energy is being consumed in the same manner miles per hour is a measure of the speed an automobile is traveling. Watts being used is calculated by multiplying volts supplied times the number of amps being consumed. A standard 100 watt lightbulb uses 100 watts at 115 volts. A toaster may use 1000 watts. The toaster is drawing electrical power at the rate of 1 kilowatt.

Kilowatt Hour (KWH) -- A measure of the quantity of energy that has been consumed in the same way that miles traveled is a measure of travel accomplished by an automobile. One KWH can be delivered in any time span. For example, the following situations each represent the consumption of one KWH: a) a 50 watt lightbulb burning for 20 hours, b) an electric clock (3 watts) operating for 335 hours, c) a 1000 watt toaster operating for one hour, or d) a 5000 watt oven operating for 12 minutes. One KWH consumed releases 3413 Btu of heat and (in Minnesota) costs the residential consumer about five cents. Typical Minnesota residences use 500 to 800 KWH per month.

Amp -- the rate of flow of electrical energy through a wire or into an electric consuming device. Watts of energy being drawn divided by the delivered voltage yields amps. Most home lighting and appliance circuits are fused to deliver no more than 15 or 20 amps at 115 volts.

Volts -- The measure of electromotive force in an electrical circuit. Most home appliances and lights operate at 115 volts, but large appliances (range, dryer) are built to operate at 230 volts. Voltage in an AC circuit can be increased or decreased by the use of a transformer. Doorbells and thermostats usually operate at 24 volts. Large power transmission lines are operated at voltages as high as 400,000 (or 400 kilovolts). In many applications high voltage is desirable because increasing voltage reduces amperage needed for delivery of a given number of watts. Reduced amperage allows for smaller conductor size and results in less line loss.

Megawatt (MW) -- Often used to describe the generating capacity of large power plants. One MW equals one million watts. A large nuclear or coal fired power plant may have 800 or 1000 MW generating capacity. Megawatt is also used as a measure of the consumer load placed on an electric utility at any one time. On July 19, 1977, Northern States Power Co. customers demanded an all-time record of 4,548 MW of electrical power.

Peak demand period//Off-peak period -- Gas and electric utilities supply customers with energy forms that can not easily be stored by consumers. Therefore, the energy must be delivered exactly when it is used by customers. Utilities must provide generating and delivery capacity sufficient to meet the greatest demand customers may ever place on the system at one time. Most Minnesota electric utility systems experience their peak annual demand during the hottest afternoon of the summer when air conditioners are straining to keep residences and commercial buildings cool. Natural gas utilities experience peak annual demands early in the morning of the coldest day of each winter.

Off-peak demand occurs both daily and seasonally. Most electric utilities operate at far below capacity between the hours of 11:00 p.m. and 6:00 a.m. Also, demand is usually lower during the fall and spring seasons. Natural gas utilities experience lowest demand during summer months when space heating appliances are shut off.

Heat Rate -- The generation of electricity is relatively inefficient. One KWH of electricity contains 3413 Btu of heat energy, but producing that KWH at the power plant takes about three times as many Btu of fuel as are contained in the KWH of electrical power. The input Btu needed for each KWH of electrical generation is known as the heat rate. Most large electric utilities operate plants with heat rates of 10,000 to 11,000 Btu per KWH.

Line Loss -- As electricity is distributed from power plants to customers there are certain losses including heating of the conductor wires, radiation leaks, and transformer inefficiency. Line losses are minimized when power is distributed at high voltage and low amperage. Typically about 15% of the electricity generated by a power plant is lost before it gets to the customer.

Horsepower -- A unit of work capacity equivalent to about 745 watts.

Electricity Pricing --

1) Lifeline utility rates -- On the assumption that electricity for lighting, refrigeration, and cooking is a necessity of life, some persons and groups suggest that the utility rates be structured in such a way that the "necessary" quantity (usually 300-500 KWH/month) of electricity would be provided to each customer at a low cost. Beyond the "necessary" quantity sold at the low rate each month, the customer would pay a higher rate for additional KWH's used.

2) Declining block rate -- On the assumption that delivering electricity to a customer involves certain fixed costs for the utility, many utilities charge a higher rate per KWH for the first small block of power used each month (often 50 or 100 KWH) and lower rates per KWH for consumption beyond the first block. This scheme makes the average cost per KWH lower when a customer uses more electricity.

3) Peak Load Pricing or Time-of-Day Pricing -- This is the concept of charging a higher rate for electricity consumed during those hours when the utility is operating at or near its peak capacity. Electricity purchased during off-peak hours would be cheaper than with conventional rate structures. The assumption is that consumers would shift more use to off-peak periods, thus reducing the need for new generating capacity. Peak load pricing necessitates more sophisticated metering equipment than is currently in use.

4) Demand Charge/Energy Charge -- Industrial and large commercial electric users are billed on the basis of <u>both</u> the monthly KWH of electricity used (energy charge, similar to that paid by residential customers) and also on the maximum wattage they have drawn at any one time during the month (demand charge). It is to the advantage of both the consumer and the utility (fewer new power plants needed) to maintain a fairly constant, flat consumption pattern.

D. <u>TERMS SPECIFIC TO COAL</u>

Lignite (Brown Coal) -- The youngest and lowest grade of coal. Lignite has a relatively low heat value per pound and is high in both ash and moisture content. Large deposits of lignite

are found in the northern Great Plains where the coal is often accessible by surface mining techniques.

Lignite generally has a low sulfur content (less than 1.0%) making it a desirable fuel for power plants. Much of the coal burned in Minnesota is lignite delivered by unit trains in 10,000 ton quantities (150 billion Btu).

Sub-bituminous and Bituminous Coal -- Medium grades of coal with relatively high heat content. Much sub-bituminous and bituminous coal is relatively high in sulfur content (up to 6%) but some deposits are as low as 1%. Bituminous coals have long been favored as a fuel for power plants and as the feed material for coking. These coals are mined by either surface or underground techniques depending on the depth and thickness of individual seams.

Anthracite -- A hard, high heat value coal with very low moisture and ash content. Anthracite is rarely used as a boiler fuel. Almost all anthracite coal is mined by underground techniques.

Ash -- One of the impurities in coal. Ash is non-combustible inorganic matter within coal. Ash content of U.S. coals varies from 2.5% to 32.5% and has a direct effect on the heating value of the coal. Ash content varies even within a single coal seam.

Moisture -- An impurity found in all grades of coal. Moisture content ranges from 1% in some anthracite coals to over 40% in some lignites. Moisture increases transportation costs and reduces the heat value of coal.

Sulfur -- One of the most troublesome impurities in coal. Much of the sulfur content in coal is discharged into the air when the coal is burned. Sulfur content in U.S. coals ranges from 0.2% to 7.0% and varies considerably between geographic regions. Western coals generally tend to be lower in sulfur content than Eastern coals.

E. TERMS SPECIFIC TO PETROLEUM AND LIQUID GASES

Crude Oil -- A naturally occurring hydrocarbon liquid which is found in a wide range of colors, viscosities, and purities. Crude oil is the raw material for the production of heating oils, gasoline, asphalt, and a number of other products.

Distillate Oils//Number 1,2, and 3 oil -- During the refining of crude oil, a significant portion (up to about 30%) can be made available as distillate oils. These oils are used as home heating fuels, diesel fuel, and combustion turbine fuels. Number 1 oil is the lightest (least thick) and can be stored for home use in outdoor storage tanks. Number 2 and 3 oils (#3 is not commonly available) are somewhat heavier and should

be stored in underground or basement storage tanks.

Residual Oils//Number 5, 6, and Bunker Oil -- These derivatives from crude oil are heavier (thicker) than distillate oils. Residual oils must be preheated before they can flow from the storage tank to the burner. Residual oils are used as boiler fuel in industry, large institutions, power plants, and steam ships. Homeowners would have a difficult time trying to utilize residual oils.

Liquified Petroleum Gas (LPG) -- Propane, butane or a mixture of the two gases is known as LPG. Propane and butane change state from gaseous to liquid when subjected to moderate pressure or cooled to low temperatures (-47°F. for propane, higher for butane) and can be stored as a liquid in pressurized tanks. Most LPG used in Minnesota is straight propane because mixtures containing a large fraction of butane might not vaporize on cold days and nights. LPG is derived from refinery operations and as a companion product with natural gas. LPG is used as a crop drying fuel, for heating rural homes, and as a stand-by fuel for some industries on interruptible natural gas. Some LPG is also used by natural gas utilities for injection (after blending with air) into pipelines during periods of peak gas demand.

Primary Storage -- Large-volume storage at refineries or pipeline terminals.

Secondary Storage -- Oil storage capacity owned or controlled by wholesalers of petroleum products.

F. TERMS SPECIFIC TO NATURAL GAS

Cubic foot/hundred cubic feet (CCF)/thousand cubic feet (MCF) -- Typical units of measure for natural gas. One cubic foot of natural gas contains 1000 Btu. Most natural gas is sold to homeowners in CCF units or "therms." One hundred cubic feet or one therm represents 100,000 Btu and sells for approximately 25 cents. Larger consumers of gas are billed for consumption in MCF (thousand cubic feet or 1,000,000 Btu).

Firm Contract -- A purchase agreement by which the natural gas utility agrees to supply the customer gas in any amount demanded at the time needed by the customer's gas-using equipment. Gas purchased under firm contract is more expensive per unit than gas purchased under an interruptible contract.

Interruptible Contract -- A purchase agreement which allows the gas utility to terminate service to a customer during periods of high gas demand. Customers with interruptible contracts must have an alternate fuel supply system. Gas is supplied to interruptible customers only during "off-peak" load times and is therefore considerably less expensive.

G. TERMS SPECIFIC TO NON-TRADITIONAL ENERGY SOURCES

Synthetic Fuels -- Man-made hydrocarbon fuels that are similar to traditional energy sources found in nature. Synthetic crude oil can be made from oil shale or coal and processed in a conventional refinery. Synthetic natural gas can be made from peat, coal, or forestry wastes. Rather high technology is generally required for the conversion of raw materials to synthetic fuels.

Gasohol -- A blend of gasoline and alcohol (ethanol or methanol). Gasohol is a registered tradename of the State of Nebraska and refers specifically to a mixture containing 90% unleaded gasoline and 10% grain alcohol (ethanol). Gasohol is reported to slightly improve fuel mileage and lower exhaust pollutants. Gasohol is not currently cost competitive with gasoline because the alcohol component in the blend costs about $2.00 per gallon.

District Heating -- The use of a central energy conversion facility to produce steam or hot water for distribution to remote points of end use such as homes or businesses. Minnesota has a number of district heating systems, mostly consisting of municipally owned steam plants. District heating systems are most economical in fairly high density areas but recent technological developments have made district heating possible in moderate density residential areas also.

Cogeneration -- Two meanings are given to the term cogeneration. In certain industrial settings the term means that steam produced by a privately owned power plant is first run through a turbine to extract a portion of the heat for electrical generation and the balance of the steam (discharged from the turbine at lower pressure and temperature) is used as process steam for the industry.

In the hot water district heating scheme being proposed for the Twin Cities area, cogeneration refers to heating water (for distribution) with waste heat from NSP power plants. Normally, power plant steam is passed through two turbines, one designed to extract energy from high pressure steam and the other to efficiently utilize the lower pressure steam discharged by the first turbine. Working together, the two turbines can convert approximately 35% of the energy value of the fuel into electricity. With district heating cogeneration the steam goes only through the high pressure turbine and gives up about 30% of its energy for generating electricity. The low pressure steam discharged by the high pressure turbine is then run through a heat exchanger where it gives up most of its remaining energy to heat water to about 275° F. The heated water is then piped to urban residences and commercial buildings. In each building another heat exchanger extracts heat for space and water heating. District heating with co-generation makes useful use of approximately 75 or 80% of the energy content of the fuel whereas electrical generation alone makes use of no more than 35%.