RESOURCE CONSERVATION REPORT

UNIVERSITY OF MINNESOTA

JANUARY 1974

Submitted Pursuant to
Chapter 778, Section 7 of the
1973 Legislative Session Laws

RESOURCE CONSERVATION REPORT

University of Minnesota
Office of Physical Planning

December 31, 1973

UNIVERSITY OF MINNESOTA
Office of the President
202 Morrill Hall
Minneapolis, Minnesota 55455

December 31, 1973

Senator Edward G. Novak
Chairman
Senate Finance Committee

Representative Fred C. Norton
Chairman
House Appropriations Committee

This report from the University of Minnesota is submitted pursuant to Chapter 778, Section 7, of the 1973 Legislative Session Laws.

Copies are available for all members of your committees. We shall be pleased to respond to any questions you may have.

Sincerely yours,

Malcolm Moos

Malcolm Moos
President

INTRODUCTION

"Energy crisis", "fuel shortage", "pollution", "brownouts" and "blackouts" are terms and issues we hear increasingly more about. As these matters continue to impinge upon and aggravate the public welfare, their solution - or at least their regulation - becomes imperative. The Federal government has occupied itself with these problems for some time. The State of Minnesota has also paid considerable attention to energy and environmental matters. The creation of a Special Citizens Task Force on Energy Policy by the Governor's Environmental Quality Council in 1972, the resolutions adopted at the Midwest Governors' Conference on Energy and Environment in 1973, and the recent directive to State agencies and institutions to conserve energy sources, for example, are addressed to these concerns.

The University of Minnesota has likewise shared these concerns for wise energy use, conservation of natural resources, abatement of air and noise pollution, and the enhancement of environmental quality. It is the purpose of this report to describe briefly the work that has been accomplished and the planning that is being done in resource conservation by the University of Minnesota in both its academic and administrative capacities.

Both as purely a practical matter and as a demonstration of leadership, the University of Minnesota is actively seeking to reduce its energy consumption, minimize its impact upon the environment, and explore avenues of resource conservation. This increased concern has been prompted in part by the rapidly burgeoning energy crisis, a desire to improve upon and expand the efforts in resource conservation by the University, and the foresight of certain members of the Board of Regents - notably, Regent George Rauenhorst - who have urged the University to take a more active and forthright role in resource conservation.

While there is general agreement about the need to ameliorate environmental problems, little is known about the practical means by which to achieve these goals. Accordingly, the University has had to engage in considerable explorations in this field and to carry on a process of self-education. To this end, University personnel have attended meetings on national, regional, and local levels to identify and discuss environmental issues. They have drawn upon the knowledge and resources of Federal and State agencies, conferred with recognized authorities on energy conservation, participated in various symposia, and conducted conferences in an effort to learn more about environmental problems and the means to handle them. They have been engaged in devising initial criteria and procedures for evaluating and effecting energy conservation, better building design, and reduced environmental impact.

The University has felt it incumbent upon itself to make exploratory investigations in this field of energy conservation, to apprise itself of various techniques and technology, and to act according to its findings. Cumulative efforts led to the establishment in 1972 of an Energy Conservation Program and an Energy Conservation Committee to coordinate its activities. The subsequent endeavors of this program can best be seen in two large areas of the University organization: Maintenance and Operations, and Physical Planning. In the former area, immediate and tangible results have been effected. In the latter, the future conservation of resources through better building design and operational procedures is the aim of ongoing efforts. A third area involved in resource conservation, the academic sector, will also be touched upon.

MAINTENANCE & OPERATIONS

For convenience in this report, maintenance and operations have been subdivided into five categories: engineering and building maintenance, heating plant, grounds and custodial maintenance, recycling, and transportation and support services. Necessarily, there is some overlapping, but in each case, the task remains the same: to achieve maximum resource conservation consonant with cost, convenience, and capability. Where

applicable, these procedures are being carried out on all University campuses.

Engineering and Building Maintenance

It is axiomatic that wasteful use of energy is costly; to reduce costs, energy-saving techniques and the wise use of energy must be employed. In 1961 the Physical Plant of the University took the first steps toward the formal approach on energy conservation with the installation of certain control and automation centers. The recent installation of an improved Delta 2000 Building Systems Automation Center on the Minneapolis Campus has greatly increased this operation. This centrally located unit monitors, analyzes, and programs heating, ventilation, and air conditioning equipment in many of the Twin Cities Campus buildings and in a few outstate campus buildings. Not only is electrical and fuel energy saved by centrally regulated heating, ventilating, and cooling operations, but the energy required to operate heating and ventilating machinery itself is also conserved. Moreover, closer and more accurate monitoring of building functions enables computerized preventive maintenance to be carried out so that machinery may be maintained properly before costly breakdowns occur. At present, over 11,500 pieces of equipment are programmed on the University computer. A further saving is achieved in manpower and costs since one operator can control and monitor functions for many buildings. Maintenance personnel are no longer scheduled

at night and on weekends and holidays except on an emergency basis. Ultimately, it is hoped that all buildings on all campuses can be linked to a single central console.

In 1972 a wise-energy-use program was initiated to encourage University-wide reduction of heating and lighting in University buildings, especially at night and on weekends. Faculty, students, and staff were asked to close windows, shut off radiators, and turn out lights when rooms were not in use. The results were very favorable, and the program has been continued.

A second major area in which engineering and maintenance is acting to conserve energy involves improved lighting fixtures and more flexible switching arrangements. Recent studies by the University's Engineering and Construction Division and the installation of experimental lighting in two Minneapolis classrooms have demonstrated the feasibility of providing adequate lighting levels through more efficient fixtures and improved switching while achieving a reduction of up to 50 percent in electrical demand. Further, because generally accepted standards for the level of illumination needed for various tasks and situations may be unnecessarily high, University engineers have looked to established minimum lighting levels and have found them entirely satisfactory. In many cases, even lower levels are perfectly adequate.

With regard to heating, ventilation, and air conditioning, the University is giving preference, where possible, to zone control systems. In this manner, conditions appropriate to each area can be achieved without unnecessary overheating or overcooling of other contiguous areas. Again where possible, measures are being undertaken to reduce unwanted heating and cooling through insulation, double-glazing, and even landscaping. Double-glazed windows, for example, are being installed in Coffey Hall, and "kool" shades have been installed in other buildings. In Duluth, the new physical education building is partially below grade. Since the ground itself provides a substantial insulating effect, considerably less energy for heating is expended. At Crookston, hundreds of feet of uninsulated heating pipes have been insulated within the past five years to reduce heat loss.

Heating Plant

In addition to campus-wide reduction of building temperatures at night and during weekends, the heating plant has striven to increase its own efficiency. Economizers have been installed which recapture lost heat to preheat water for the boilers and air for the burners with a 10 percent increase in efficiency realized. Where possible, boilers designed and assembled to meet specific conditions at the University are given preference over factory-assembled

boilers of fixed capacity. Additionally, turbine drives are utilized as much as possible rather than electric drives, a practice demanding substantially less energy for operation.

Air pollution has been abated somewhat by the installation of mechanical collectors on all stacks, the use of expensive non-sulphur and low-sulphur fuel oil, and preheating air for better combustion. The threat of a severe fuel shortage, however, may necessitate the return to fuel oil with a higher sulphur content.

Grounds and Custodial Maintenance

Installation of the Building Systems Automation Center has eliminated the need for a deep-night maintenance shift (12:30 a.m. - 6:00 a.m.). The result has been a saving of electrical energy for lights and mechanical equipment as well as manpower and costs. Custodians, who customarily work at night, have been instructed to turn off lights whenever possible in the course of their rounds. Bio-degradable cleaning agents are being used for cleaning purposes wherever possible.

In an effort to reduce noise and air pollution, electric mowers are being used by grounds keepers. However, these units will be phased out to conserve energy in favor of quieter gasoline engines with improved pollution control

devices. Rubbish collection trucks have been equipped with electric drives and silencers in order to effect noise abatement.

Recycling

In an attempt to curtail the ever-increasing avalance of waste paper, efforts have been made to encourage recycling of paper by distributing collection barrels around the campus. On the Twin Cities Campus, for example, four and one-half tons of waste paper a day are collected and sold to a paper reclaiming firm. Similar efforts are being made at the Duluth campus. The demand and price for scrap paper has increased steadily, making this operation doubly economical. Glass containers are reused where there is no danger of contamination, otherwise these too are sold to recycling firms. Retrieval of chemicals, notably mercury, has been successful to a degree.

At the experiment and research stations, animal waste recycling is also practiced for both practical and research purposes. Projects have included the use of animal wastes for fertilizer and for methane production, and the use of processed manure for cattle feed. Environmental effects from the overuse of fertilizer are also being studied. At Rosemount, University scientists are recycling human sewage in an effort to find the most economic and ecologically beneficial use for this raw material.

The University has also cooperated with Hennepin County in a study for the construction of a solid waste resource recovery and energy system in the Cedar-Riverside area. The project, development of which will be staged over the next twenty years, calls for the collection of solid waste by truck and by pneumatic tube from the local residential and institutional community. This waste will be incinerated, and the energy obtained thereby will be returned to the community for heating and cooling purposes or be fed to a generating turbine to produce supplemental electricity for local use. Feasibility studies on this project are now being concluded. It is anticipated that when this plant is built, the University and other local institutions will be among the beneficiaries of supplemental steam heat and electricity.

Transportation and Support Services

In response to the continual and ever-increasing traffic and parking congestion, the University is placing greater emphasis upon exploring and developing alternative solutions to campus traffic. In 1971, the University initiated an express bus system which provides direct service to the Twin Cities campuses from outlying points throughout the metropolitan area. This program continues to receive prime attention, and work is being carried on in this area. Seven routes are currently in operation serving commuters during the peak traffic

morning and afternoon hours. Ridership increased 31.2 percent from Fall, 1971 to Fall, 1971, and in the past year it has increased another 9.3 percent.

Combined with this program of express busses, computer car pooling has been initiated at the instigation of the University. Restriction of designated parking lots to car pools, increased parking lot rates, free parking in outlying parking areas, and the closing of arterial streets within the University have worked to alleviate traffic congestion and to curtail use of cars.

The University has encouraged the use of bicycles as an alternative means of transportation since it alleviates and reduces the use of automobiles and consequent air and noise pollution. With an estimated 5,000 bicycles on campus at peak times, the University undertook a study of bicycle circulation. As a result of that study, an experimental program of bike lanes was created, guidelines are being established for the use of bicycles on campus, and bike racks provided.

Support service vehicles, which previously had to be kept running in order to operate tube-type communication radios, have been equipped with transistorized radios, thus eliminating the need to keep the vehicle running. In addition, University vehicles are not permitted to exceed 50 miles per hour. The use at times of non-leaded fuels, consolidation of delivery routes in

order to minimize the number of deliveries, increased diagnostic preventive maintenance of all University vehicles, and increased use of compact rather than full-size cars for official business by University personnel are other small but significant contributions to the conservation of resources, reduction of pollution, and minimizing of environmental deterioration.

PHYSICAL PLANNING

More far-reaching though at present less tangible efforts are being pursued in the physical planning sector of University operations. Work in this area ranges variously from preliminary discussions and formulations to procedural changes in planning and program functions to operational research and experimental projects. Discussion in this portion of the report is subdivided under Engineering and Design, Projects, and Transportation.

Engineering and Design

Planners, architects, and consultants involved in physical planning at the University of Minnesota are paying increased attention to energy conservation and environmental impact. Long range development plans for the St. Paul and the Duluth campuses attest to this. Indeed, it is only prudent and economical to do so. It is established policy of the Board of Regents to take into

account the conservation of natural resources in the construction, renovation, and operation of University structures and the optimum utilization of space in all future building and building site schemes.

New buildings offer the greatest opportunity for energy conservation. Employing innovative techniques, more stringent standards, and technological advances, thoughtful design and engineering can render substantial economies in energy use, minimize the impact of a building upon its environment (indeed, even enhance the site), and at the same time lower overall costs of the structure.

Planning operations at the University of Minnesota are taking place on several fronts. Because much is said but little known about the means, technology, and results of resource conservation, the University has researched and assembled data from U.S. Government reports, industry manuals, and articles on a broad spectrum of energy-oriented topics by authorities in the field. Extensive conferences with specialists in design standards for heating, lighting, transportation, and the like have been carried on. Architects and engineers have been consulted. Meetings with the National Bureau of Standards and the General Services Administration have been held. Symposia on energy conservation matters have been attended and meetings conducted

during which involved personnel were able to discuss the subject with nationally recognized authorities on energy conservation. Additional meetings have been and continue to be held with University faculty members conversant with resource conservation.

The outcome of these meetings, research, and other discussions within the University has been the creation of a program to conserve energy in the University plant. From this program, in turn, have emerged a series of actions and documents for planning, programming, and evaluating energy conservation measures.

One such document pertains to the method of Life-Cycling costing. Contrasted with initial-cost procedures, this method compares life-term costs of alternative designs for those building elements which can exert significant influence on decisions about energy conservation and ownership costs. Frequently, it has been found, initial costs for building design and equipment utilizing energy conserving principles are greater but that over the life of the facility considerable savings in maintenance costs and energy consumption can be achieved.

A second major document relates to performance standards. Comprehensive in scope, this recently updated study in part outlines University policies and

objectives concerning conservation of resources that are to be observed in the design of University facilities. Standards for insulation and heat loss (U factors) for various situations, the amount of glass for exterior walls, the kind and efficiency of mechanical and electrical systems, and the minimum requirements for heating, cooling, and ventilation under different conditions, for example, have been subjected to careful scrutiny.

A third document involves setting up and evaluating experimental lighting in two classrooms. As mentioned briefly in an earlier portion of this report, this study concerns the determination of adequate lighting levels, flexibility of switching, lamp type and efficiency, placement of fixtures, maintenance, aesthetic considerations, and user response. The interrelationship of lighting to heating, ventilating, and air conditioning loads has also been taken into account for further exploratory efforts. Definitive conclusions have not yet been reached since the experiment is still operational, but it is anticipated that a better understanding of lighting levels and illumination techniques as well as an appreciable saving in energy and related costs will accrue.

Another and perhaps the most important area in which planning attempts to employ resource conservation principles concerns architectural design and

building systems. Architects and planners of University facilities have been specifically charged to apply energy conserving techniques in the design, construction, and operation of University facilities. Utilizing performance standards and life-cycle costing methods, planners consult frequently with architects, engineers, building committees, administrative officials, and future users of the building. Site location, building structure, heat loss/gain factors, glazing, mechanical and electrical systems, building materials, space utilization, occupancy load, landscaping, and the like are considered from the point of view of cost, energy conservation, maintenance and operation, and so forth. While radical measures are avoided, demonstrably effective methods of energy conservation are taken.

Every effort is made where feasible to reduce energy consumption in a facility and to conserve energy by recapture or reuse. Many techniques are available. Limiting the area of glazing to that necessary for the essential functioning of the building is one means. Buildings with large, non-structured open areas suitable for multi-use are inherently more economical from the standpoint of both initial construction and long term operations than cubicle structured spaces. Assigning a maximum average number of watts per square foot permits low levels of illumination in areas of low occupancy and higher levels where necessary without exceeding predetermined limits. Similarly, reduced heating

and cooling requirements in areas of low occupancy result in savings. Reducing the quantity of fresh air per person required will curtail the amount of energy used by ventilating and reheating equipment. Use of fume hoods only where necessary and only when needed instead of incorporating them in the general ventilation system will limit the amount of heated exhaust air lost from a building. Decentralized low pressure fan units are generally more economical than high pressure, high horse power central fan systems and should be used where possible. Heat wheels and heat exchangers can be installed to recapture heat lost in exhaust air. Heat thus recaptured can be used to preheat air or domestic water supplies. Revising design practices for heating and cooling systems to accommodate outdoor conditions not exceeded more than five percent of the time instead of the present two and a half percent standard can result in appreciable economies in equipment cost and energy use. Similarly, elimination of improper oversizing of equipment to accommodate excessive load calculations and safety factors can also achieve significant savings. These are but a few of the many energy saving techniques that can be employed. Specific examples of this kind of planning will be found in the following section on projects.

Projects

Principles of resource conservation are applied wherever possible in all projects, and to enumerate them all would be both tedious and presumptuous.

Some projects are particularly noteworthy, however, and those below demonstrate current resource conservation principles and methods in new construction and remodeling.

Continuing Education Facility: This facility was selected to be the first major project in which special attention would be given to employing energy conservation in building design and construction. The approach has been to design the building from the beginning to take advantage of all feasible, proven means within cost limits by which the conservation of resources might be achieved. This approach, it is felt, will minimize possible extra costs in both design and construction. The following major energy-saving techniques are being employed:

1) The building will incorporate a minimal amount of exterior glass, thus minimizing energy requirements. Glass introduced on the north side does not have the problem of heat gain. Heat gain from glass introduced on the south side will be controlled by overhang and landscaping.

2) Spaces within the building which require high levels of temperature control do not abut directly on exterior surfaces. Rather they are surrounded by spaces which do not require the same levels of temperature control and which therefore serve as a buffer.

3) All walls and ceilings are heavily insulated.

4) The ventilation system has been designed to respond quickly to changes in internal building conditions, thereby eliminating unnecessary overheating and overcooling.

5) Interior rooms are supplementally heated with the heat from the lights.

6) Variable switching permits proper lighting to match demand without overlighting. Efficient light fixtures that provide the most light for the least energy are being used.

7) Building control systems have been designed to accommodate reasonable loads and safety factors. Efficient management of all building systems will greatly reduce energy consumption.

The net amount of energy saved using these techniques and present building codes is approximately 25 percent compared to a building not employing energy saving methods.

Medical Complex Heating, Ventilating, and Air Conditioning Systems: In the Physiology Research Labs on the fourth floor of Lyons Lab, a system using a central air handler for ventilation air only and individual fan units

in the space for heating and cooling has been installed instead of the conventional central air handling system. This method has resulted in a 40 percent savings in the energy required to heat and cool the space and still provide adequate ventilation. The installed refrigerant water chiller capacity was reduced from 56 tons to 30 tons. The type of system installed represents a 25 percent electrical energy savings over window air conditioning which has a lower first cost.

Remodeling projects on the second and third floor of Variety Club Heart Hospital and in the Pediatrics Wing in the University Hospitals utilize mechanical systems that are more efficient from the energy conservation aspect than those previously installed. They incorporate a central air conditioner for ventilation air with thermostatic controlled radiant panels in each space served. These systems eliminate the need to cool and reheat large amounts of air, which is typical of conventional reheat systems. Energy savings here are not as dramatic as in the Physiology Labs because very little of the space requires 100 percent exhaust. However, the energy savings would be substantial over the conventional central air handler system with reheat coils for controlling room temperature.

Experimental Lighting Project: Two rooms have been selected for illumination experiments. In room 215 Aeronautical Engineering, seven rows of five four-

foot long fluorescent lamp luminaires have been installed with switch controls for three levels of lighting and control of three rows of lights next to the window wall. In room 60 Ford Hall, four rows of five four-foot long fluorescent lamp luminaires have been installed with switch controls for three levels of lighting.

The purpose of these installations and switching arrangements is to determine and evaluate minimum lighting levels, user comfort, most efficient fixtures and lamp types, effects of lighting on heating, ventilation and air conditioning, installation costs, and maintenance requirements.

Project Ouroboros: In April, 1973, facilities were provided at the Rosemount Station for construction of an experimental house. Entirely student-built and student-designed under the supervision of staff in the School of Architecture, it represents a major innovative endeavor on the part of the faculty and students to explore and employ energy-saving principles and make use of available natural resources. The aim is to build a house suitable for comfortable living without depending upon the usual energy consuming features like plumbing, gas, and electricity. Heating for rooms and domestic water supply is furnished by solar collectors, and electricity is provided by a windmill. An "aerobic compost toilet" is used, with air-filtered and purified

wastes used to fertilize lawns and plantings. The slanted roof will be covered with sod enabling snow in winter to provide additional insulation and enhancing cooling in summer through evaporation of dew.

Cooke Hall and Norris Gym: Major remodeling of these two facilities has been deemed an appropriate project for the study and application of energy conservation techniques. This proposal is in the beginning stages at this time, and specific recommendations have not been made.

Johnston Hall: This building will be the target for energy conservation improvements in heating, lighting, air conditioning, and ventilation. Preliminary studies and discussions on programming and implementation are now being conducted. This project will also provide a model for future resource conservation improvements in older buildings of this type.

Transportation

To achieve effective planning and regulation of traffic circulation and distribution on the Twin Cities Campus, the Planning Office is participating in the University Area Transit Study (UATS), currently being conducted by the Metropolitan Transit Commission with the cooperation of the Minnesota Highway Department, the Metropolitan Council, and the Cities of Minneapolis and St. Paul. The goals of this study are to maximize accessibility to the

Twin Cities Campus, to provide optimum movement of people and goods between campuses and between residential, commercial, industrial, and institutional concentrations in the University study area, and to provide a circulation and distribution system that has expansion flexibility.

In addition, University planners are working to achieve a reduction in automobile traffic, an effective parking system that relieves the need for auto travel and parking within the University study area, and increased use of mass transportation. In this way the University expects to maximize its opportunities to improve the environment and minimize the negative impact. Ideally noise and air pollution will be greatly reduced, energy fuels conserved, unsightly and unpleasant traffic congestion ended, and the natural environment enhanced.

Mass transit represents an important part of this planning. Transit systems that provide rapid and efficient transportation and which minimize noise, air,and sight pollution and have minimum right-of-way and land-impact requirements are being studied. It is desired that any such system use only a fraction of the energy per passenger-mile that conventional transportation modes consume and that only less critical types of energy sources be used. Planning for such rapid transit systems is still in a nascent stage,

but impact upon the environment and conservation of natural resources constitute major concerns.

ACADEMIC

An impressive array of research programs and study opportunities in environmental matters exists in the academic sector of the University. Environmental instruction and research pervades most of the program of the Institute of Agriculture; it is important in total quantity in the Health Sciences, Technology, and Liberal Arts; and it is significant in Education and Law. The faculty currently teaches problem-oriented, multi-disciplinary courses and seminars at both the graduate and undergraduate levels. Multi-disciplinary programs on particular environmental problems are also developed by individual students at their own initiative. Components of the natural environment under study include fish and wildlife, streams, lakes and lakeshore, water supplies, soils and forests, and the atmosphere. Studies are also being conducted on insecticides, pesticides and fertilizers, irrigation, water treatment and disposal, noise, air pollution, and the like.

A variety of administrative frameworks and programs exist to meet the multi-disciplinary requirements of environmental research and study. A few are

described below:

The All-University Council on Environmental Quality was first appointed in 1971 to examine existing University programs in environmental matters, explore needs, and suggest possible new or revised programs. Since that time, its efforts have resulted in periodic recommendations to academic and administrative offices at the University, public service radio broadcasts on environmental topics, intercampus meetings and symposia on a host of environmental matters, and the compilation and distribution of a comprehensive course bulletin on environmentally related courses and programs.

The Center for Studies of the Physical Environment coordinates the environmental concerns of the Institute of Technology. Its primary responsibilities are to act as a forum for the discussion of proposed courses, act as a clearing-house in relation to research and training programs, develop and coordinate a series of seminars on environmental problems, and act as the forum through which interdisciplinary research programs can be developed and coordinated. Among other programs that it sponsors is the Environmental Intern Program for undergraduate students to work with state and local agencies. The objective is to give interested students direct experience with ongoing or new programs in environmental protection and conservation. Participating

agencies include but are not limited to the Minnesota Pollution Control Agency, the Department of Natural Resources, the Department of Agriculture, the Highway Department, the Metropolitan Council, the State Planning Agency, and the Department of Economic Development.

The Center for Urban and Regional Affairs (CURA), established by the Regents to help make the University more responsive to the needs of the larger community, helps coordinate and stimulate projects in such problem areas as housing, human relations, urban transportation, waste management, local government reorganization, and diffusion of information about these topics. These problems cut across a wide and changing array of disciplines and colleges.

Another environmentally oriented organization is the Minnesota Public Interest Research Group (MPIRG), a non-profit, non-partisan student-funded organization representing the concerns of Minnesota college students. Areas of MPIRG concern include environmental protection, consumer protection, health care delivery, housing, human rights, occupational safety, and similar matters in the public interest.

Typical of the many specialized environmental groups are the Limnological Research Center, which carries out research on the physical, chemical,

biological, and geological aspects of lakes, especially lakes in Minnesota, and the Water Resources Research Center. This latter has responsibility for stimulating University of Minnesota and state and private college water resources research through administration of funds associated with the Federal Water Resources Act; coordinating the research with programs of local, state and federal agencies and private organizations throughout the state; and assisting in training additional scientists for work in the field of water resources through research.

The Environmental Health Research and Training Center is concerned with the examination and evaluation of environmental factors in relation to the health and well-being of man. Utilizing vital statistics data, epidemiological methodology, and total environmental input - air, water, land, noise, stress, etc. - the Center brings together a multi- and interdisciplinary approach to environmental health problems.

CONCLUSION

The need for conservation of resources and reduction of detrimental impact upon the environment is clearly at hand and has been for some time. The University has responded to this need. It has initiated environmental studies, implemented energy-saving techniques where possible, and encour-

aged the conservation of resources. The Board of Regents has established as University policy the consideration of natural resources in all University physical planning.

In order for the University to continue its work and to provide leadership in resource conservation, increased efforts must be made. The University intends to meet this obligation. Although this will require additional time, funds, and manpower, much stands to be gained by such initiatives. A damaged environment can be restored, resources can be conserved, and fiscal gains can accrue through wise planning and greater use of energy-saving techniques and technology.