1st Annual Report

Nebraska Energy Office

1978

Letter of Transmittal

December, 1978

Honorable J. James Exon
State Capitol
Lincoln, NE 68509

Dear Governor Exon:

I am pleased to submit to you and the State Legislature the first Annual Report of the Nebraska Energy Office in accordance with the provisions of Section 81-1604, R.R.S., 1977 Supplement.

The report contains a summary of the activities of this Office since its inception in November, 1973 as a Petroleum Allocation Office during the Mideast conflict and oil embargo that followed. Included you will find references to the number of hardship cases assisted and Nebraska's fuel use pattern.

With the reduction of emergency fuel requests in 1975, the Office began to create, publicize, promote, and assist energy conservation efforts in Nebraska. The pioneering Nebraska Plan energy audits of commercial facilities were begun in that year. The year 1976 brought the innovative Kansas-Nebraska Agricultural Program and the first "March as Energy Conservation Month" emphases into being. The year 1977 was dedicated largely to the creation of a State Energy Conservation Plan in fulfillment of the requirements of the Energy Policy and Conservation Act of 1975 (P.L. 94-163) and the Energy Conservation and Production Act of 1976 (P. L. 94-385).

An evaluation of Nebraska's energy situation through calendar 1977, the last full year for which complete data is available, has been made by sector and by fuel type, plus certain current reporting statistics for 1978. It reminds us that our State is heavily dependent on outside sources for the fuel and energy we all depend upon. Careful planning for effective utilization of these increasingly precious commodities is required to meet present requirements and future growth.

The Nebraska Energy Office's policy has been one of full cooperation with all energy-related sectors of the State, both public and private. This approach has resulted in joint conservation efforts that no other state can match. A continuation of these successful relationships for the future is necessary.

I want to thank you for your personal interest in energy matters and for your creation, by executive order, of the Governor's Energy Advisory Committee to channel the energy involvement of State agencies. Lt. Governor Gerald T. Whelan's personal dedication, as Chairman of the Committee, has been of tremendous value and is deeply appreciated.

Because energy will receive substantial legislative and administrative attention in 1979, it is my hope that this Report will be of particular assistance to the Governor-elect, Charles Thone, and to the Unicameral.

Sincerely,

NEBRASKA ENERGY OFFICE

George J. Dworak
Director

GJD:grh

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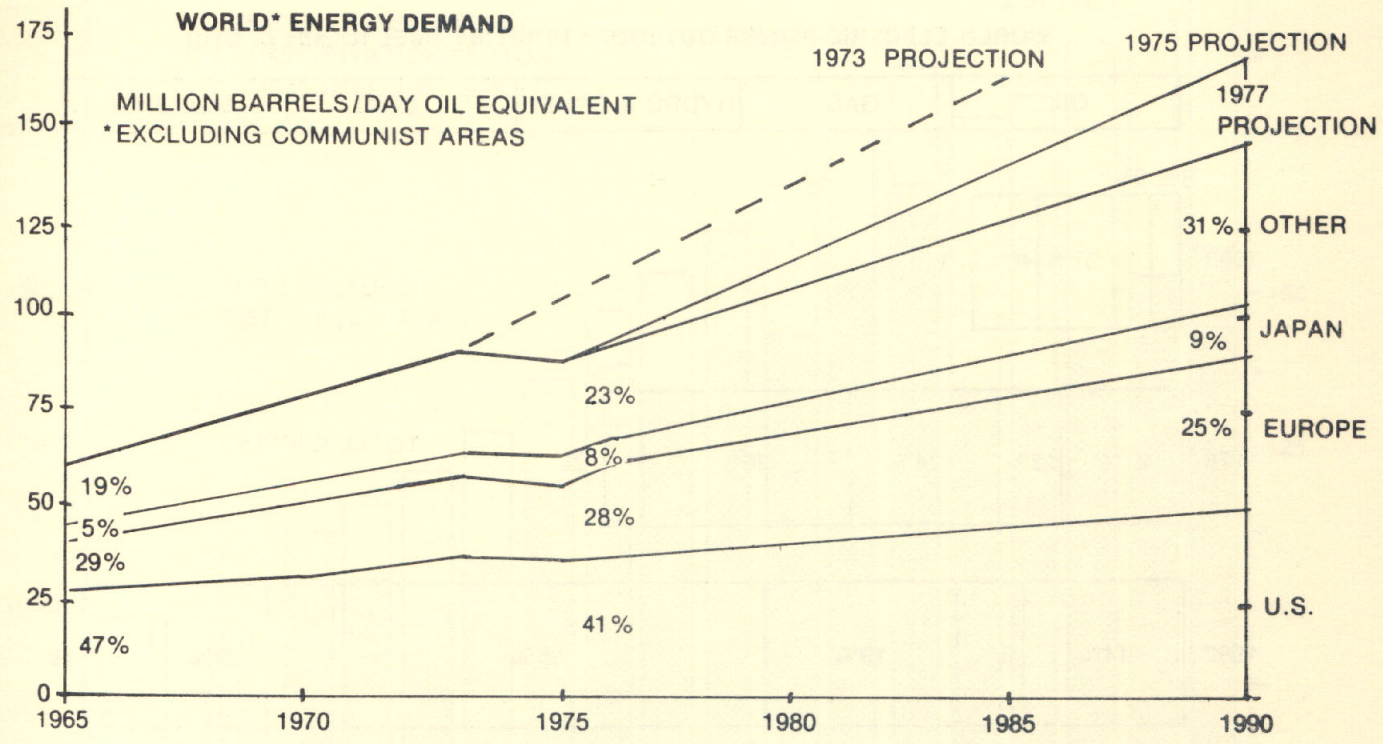
The World's Energy

FIGURE 1



The two previous revolutions experienced in the field of energy involved technological, economic, and environmental factors, and these three elements are evident in the current metamorphosis where a change from fossil fuels to alternates as principal fuels in the coming generation is declared by the experts to be the inevitable third revolution of its kind in the space of a little more than two centuries. The changeover from wood to coal two hundred years ago was dictated by the fact that the new steam technology required the expenditure of energy at such a rate and in such centrally localized emplacements that, while possibly feasible from a technological point of view, the use of wood could not be justified on a cost basis alone. Coal mines, especially in England, Continental Europe, and the United States, were sufficiently centralized that the sheer weight of transportation costs involved in moving forest-harvested wood into urban centers ruled in favor of a switch to coal. Added to the economic infeasibility of using charcoal instead of coke was the fear, perhaps only intuited at the time, of destroying the normal environment. Thus, in retrospect, it was inevitable that there be a switch from wood to coal in the eighteenth century as the Industrial Revolution assumed the main thrust of its development in steel, railways, and other heavy industry.

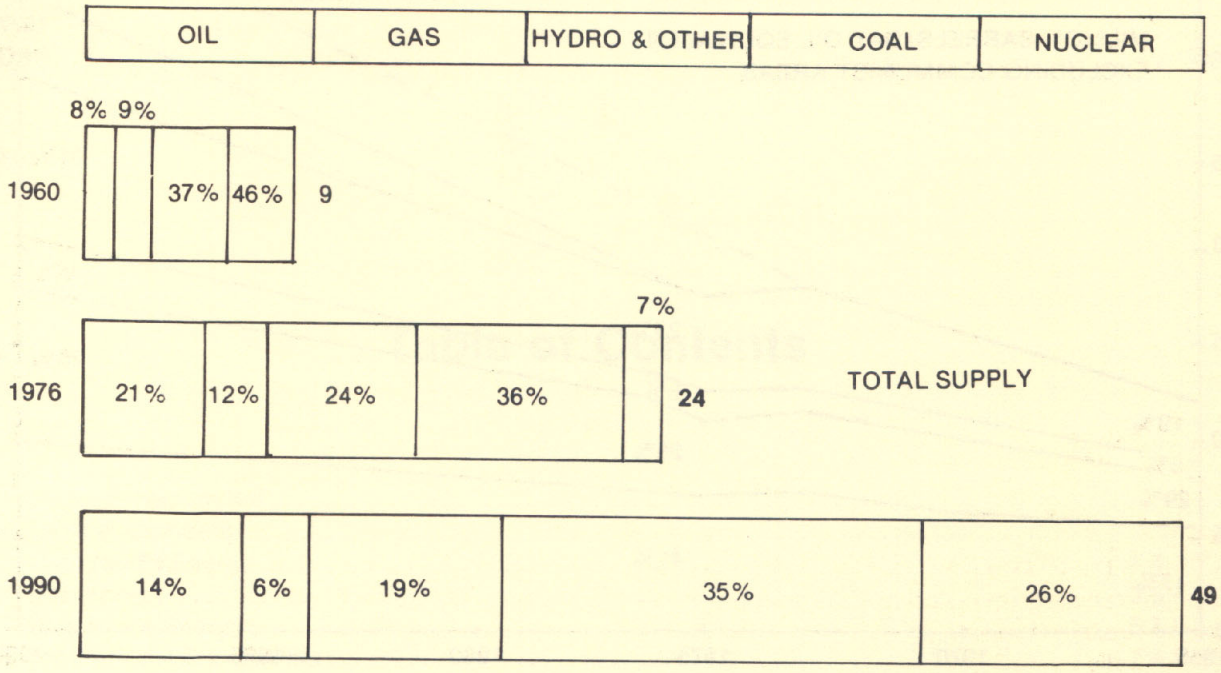
At the beginning of the Twentieth century the internal combustion engine was a prime technological factor in bringing about the petroleum revolution. While it is true, as the European experience demonstrated in two World Wars, that Internal combustion engines can be run on coal and even wood derivities, the use of gasoline was identified with automotive expansion from the start Transport facilities again played a leading role. The ocean-going tanker and the land pipeline made it possible for petroleum products to compete costwise with coal in most markets. Ecological and humane considerations added to economic and technological advantages for an accelerated use of petroleum in place of coal. Gasoline and natural gas for heating and automotive purposes were found not only to be much more convenient for these tasks than other fuels but the adoption of the fossil fuels also did wonders for the environment, at least in the short run, before the proliferation of automobiles rendered the ecological argument for petroleum less than satisfactory. Concommitant with automobile expansion, electrical power production was more and more apt to use natural gas and petroleum itself for an energy source.

The age of petroleum was not to consume a lengthy period of time because the reserves of this fuel, always known to be limited in nature, suffered quick and enormous attrition partly as a result of World Wars I and II. Russia affords a striking example of the world-wide and rapid depletion of these reserves. It had

The World's Energy

FIGURE 2

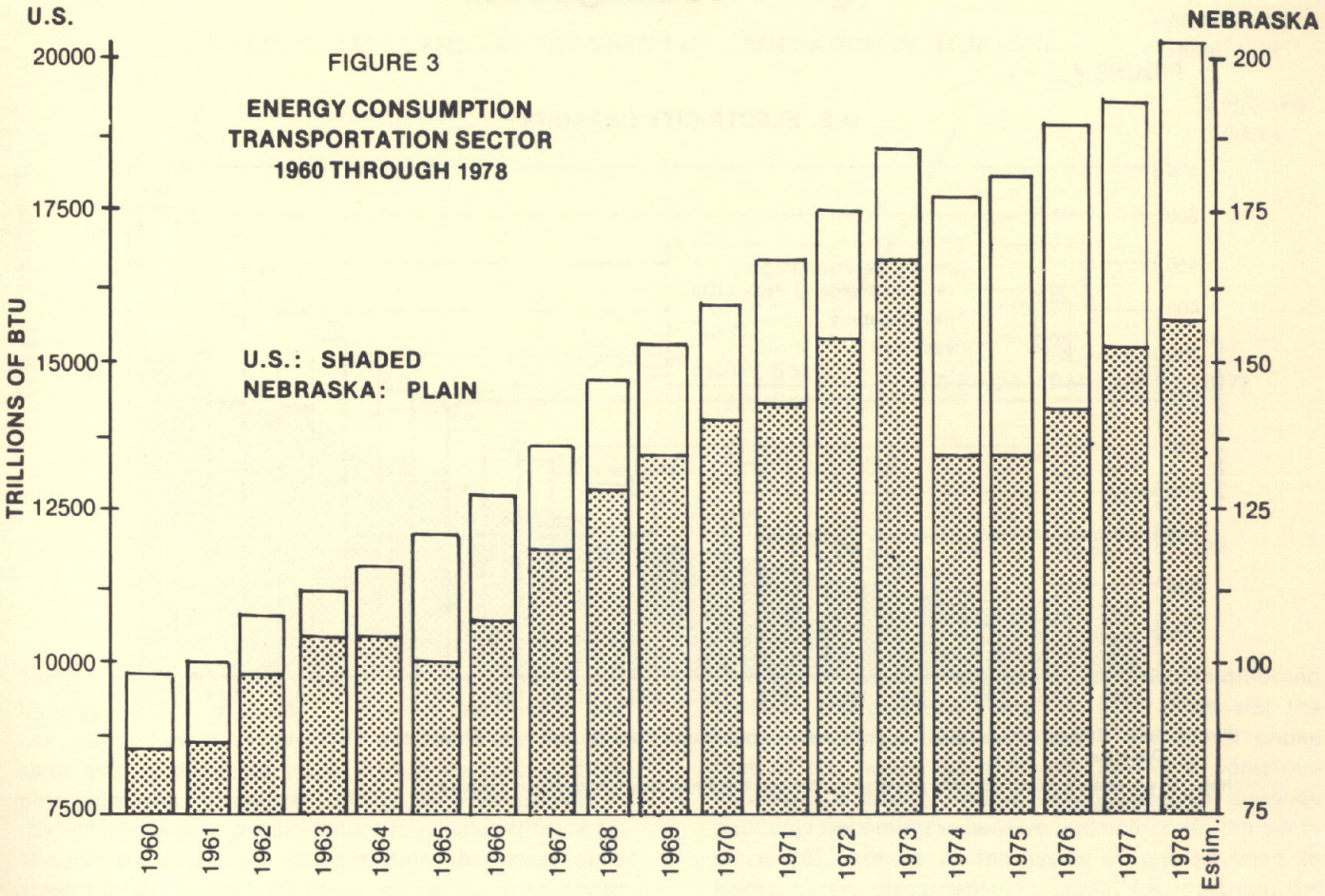
WORLD ELECTRIC POWER OUTLOOK: INPUT BY FUEL [Quads of BTU]



been thought that the reserves of petroleum within the boundaries of Russia would support two centuries of industrial expansion. Now some experts are saying that Russian reserves of oil will be in a serious state of depletion by 1982. The situation world-wide is somewhat the same, and this is pointed out by the graph on page 1 (Figure1). The Third World, last of the planet's surface to experience the industrial revolution, asserted its need for those primary energy sources that were the accustomed fuel base for the living standards of the West. Petroleum began to be used and shared by all the earth's people. It is remarkable that the percentage of available fossil fuel production in the world provided by the United States has decreased from almost fifty to about thirty-five percent in a single generation. This shrinking of shares, characteristic of the percentage of these fuels taken by all the industrial nations, is a phenomenon that will play a large role in shaping international affairs and world economics for some time to come. Even now we see the inevitable use of coal, as in the case of electrical generation pointed out in Figure II, where substitution of coal for petroleum has been substantial in recent years.

Petroleum is not as extensively available throughout the industrialized world as coal. Petroleum, as is evident to all since the time of the Arab Embargo in 1973, is found in areas of the world that have little industry. Until the North Sea discoveries, which are very recent, Europe itself was almost entirely dependent upon foreign oil. The distances between consumption points and production areas for oil are immense. In fact, a whole new transport industry involving lengthy pipelines and the largest ships ever made, has risen up in response to this dispersion. But transport of this product from source to refining areas is only one half of the problem. Many of the developing nations who are striving for standards of living enjoyed by the industrial giants are located near the areas where the crude oil is found in its unrefined state. Peoples unaccustomed to industrial living have no pool of skilled labor to operate sophisticated refinery emplacements, nor do they have the capital accumulation to erect refinery industries of their own. In spite of the huge transportation costs involved, the Third World has been willing to pay the price by reducing demand for other things that are adjunct to human life as we know it. There developed, then, a world sellers' market in petroleum, the industrial nations wishing to maintain their petroleum-based life styles and the emerging and developing nations willing to pay the high energy price encumbant upon those wishing to adopt standards of living that characterize the modern industrial state.

U.S. Energy



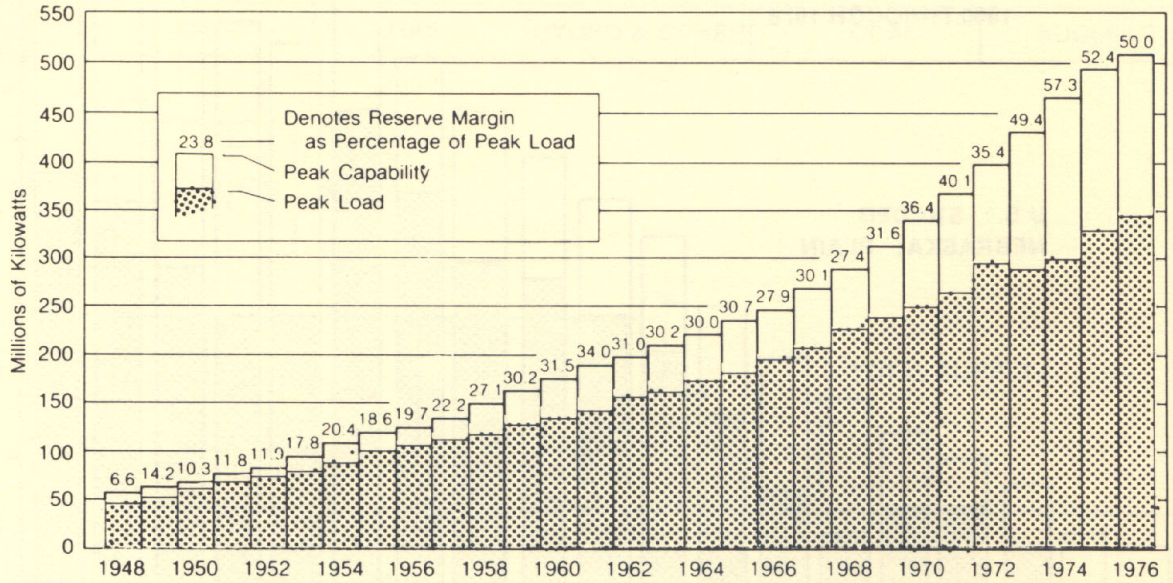
The world-wide developments following the increased demand for energy based on changed lifestyles in many parts of the world increased costs of petroleum. The widespread strains on the capital structure of industries engaged in the energy field had marked effects on the American scene. The tremendous increase in automobile ownership in the United States after World War II, the increased use of fuel by the entire transport industry, as depicted in Figure III, and the quantum growth in sales of consumer durable goods such as electric washers and dryers, refrigerators, air conditioners and home appliances acerbated the underlying demand-supply situation in energy. It is sometimes forgotten or overlooked that such industries as computers, space technology, and other new industrial dimensions of the American economy after 1946 were heavily energy-based.

Automotive engines were the market for a vastly expanded petroleum refining capacity. The refinery industry and its new emplacements developed characteristics that were to prove to be sources of difficulty for America in the future. The location of the new refineries was in the new population centers, such as the Sunbelt (Southeast, Southwest) and California. These were removed geographically from areas where heating oil and heavy industrial oil had been traditionally in demand, so the new refinery apparatus was geared from its inception to the processing of "sweet", or low sulphur crude oil. The timing was unfortunate from a balance-of-trade point of view, since in this very period the supply of domestic low sulphur crude oil was curtailed by virtue of shrinking reserves. It is well to mention here that even the new reserves found on the Alaskan North Slope are of a high sulphur type. With automobile and truck demands rising to ever increasing heights, domestic supply of gasoline, usually refined from low sulphur crude oil, became more and more limited, forcing a dependence on foreign oils that are low in sulphur.

As a result of this turn of events, the United States found its recently converted heavy industry, now dependent on natural gas and heavy distillates, and its newly increased petroleum capacity both experiencing a vulnerability that was built into the technostructure itself. To convert heavy industry back to coal and to retrofit low-sulphur-geared refineries would not only require huge amounts of capital but lengthy periods of time. The events of the period that followed the Arab Oil Embargo of 1973 must be viewed in the light of this situation. Taking these matters into account the

FIGURE 4

U.S. ELECTRICITY CAPACITY



Source: Edison Electric Institute, *1976 Year-End Summary of the Electric Power Situation in the United States*, December 31, 1976, p. 10.

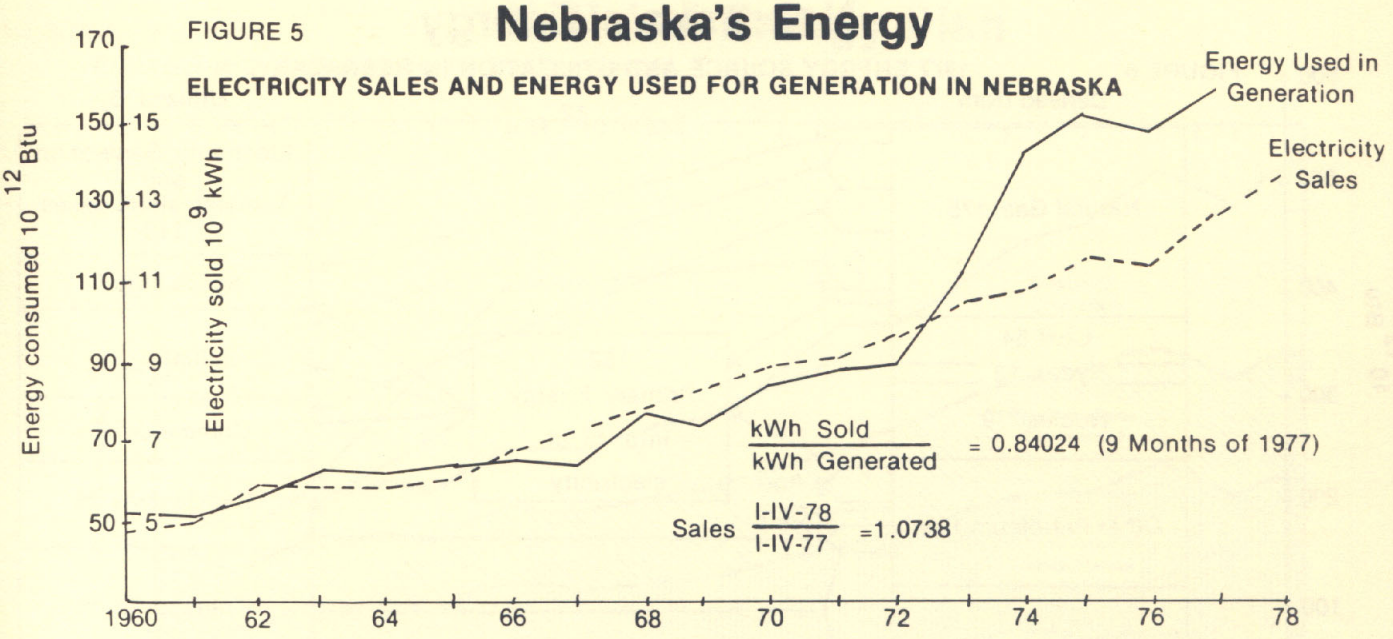
Note: All values are for *December* and do not reflect the fact that the maximum loads in some regions occur in *summer*.

highly-analytic report of President Carter in announcing the National Energy Plan indicated that a rather lengthy time period would be required to effect the changes necessary to free the country from dependence on foreign oil and develop new energy sources.

The residential, agricultural, and industrial dependence of America on electricity has been noted, but it should be pointed out at this time that electricity is not a primary energy source. Electricity itself is generated by use of coal, oil, natural gas, or hydropower. Coal was the original source of energy for the early American electrical generating industry. Later came the period of huge dam construction and a time of high hopes for hydropower as a means of turning the generators. Then, after petroleum-related fuels were found to be more expansible and almost as cheap as other sources, great promise was held out for oil or gas-fired electricity generation on a universal scale. Finally, installation of atomic reactors to operate electric power generating stations became another energy source. The electricity expansion shown in Figure 4 was accomplished, for the most part, by means of natural gas and petroleum as energy sources. Both were comparatively cheap and neither had the ecological hazards of coal or the psychological difficulties of generation through atomic fission. Fortunately for the United States, the very nature of the energy-intensive expansion before 1973 affords the grounds for comparatively effective short run action. A good deal of the fantastic growth in many sectors of the American economy during that period may be attributed to the fact that energy was cheap and planning proceeded accordingly. During that time buildings were constructed with little consideration for energy conservation. The wider use of electricity resulted in generally less efficient use of other energy sources such as coal, gas and oil. This situation becomes more clear when one realizes that primary energy sources lose two of three BTUs when converted into electric energy. As a result of low energy prices, energy was used in preference to higher scaled technology and more efficient general operational programming. At the end of the period a curious situation prevailed in that America, the giant of the industrial age and consumer of over thirty-five percent of the world's available energy, ranked very low among the nations in energy use efficiency. Thus, it became the goal of national policy in the post-1973 period to increase efficiency in energy use through conservation programs and energy-saving techniques.

Nebraska's Energy

FIGURE 5



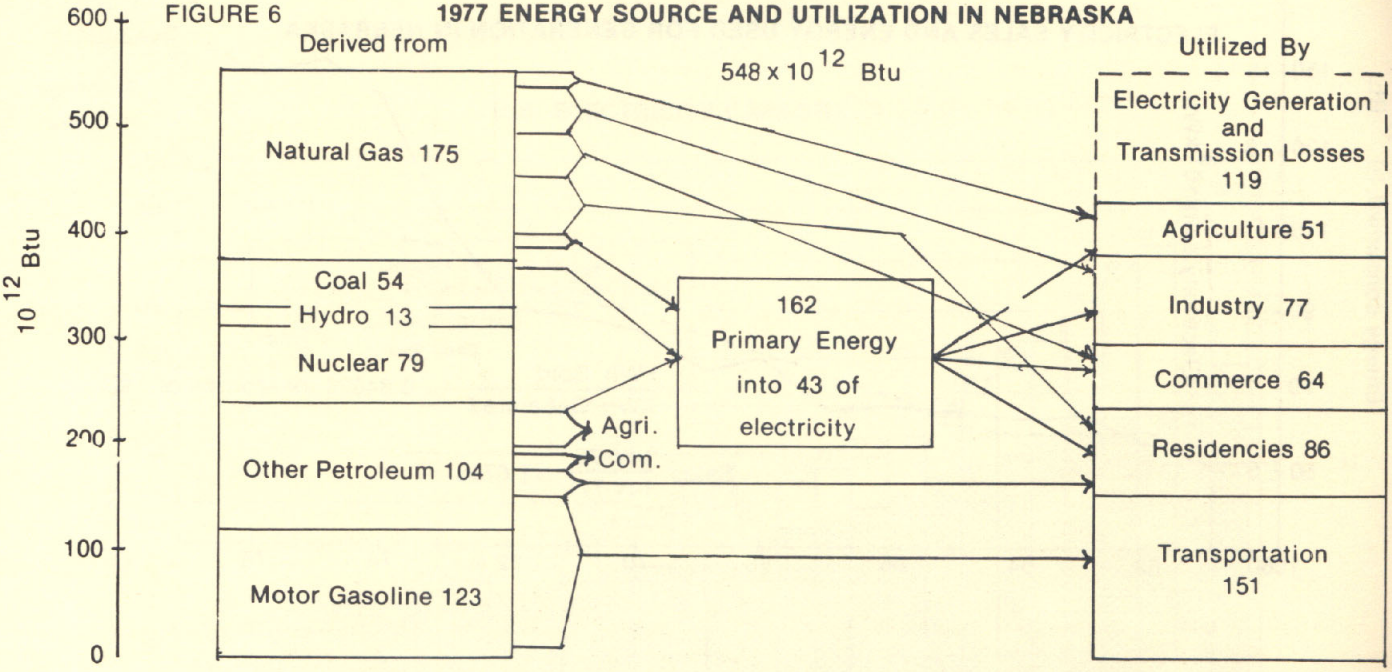
Though having its unique pattern of energy consumption by source and use, Nebraska resembles the national picture in the pre-1973 period. There was the same almost profligate use of energy sources such as petroleum and natural gas, along the lines shown in the accompanying graph of electricity sales (Figure 5). Though its electricity consumption increased at a steep rate in the pre-1973 years, especially from about 1960 onward, the State's expenditure of fossil fuels did not suffer from this increase, as about one-half of present electricity is generated by atomic fuels and the other half by coal and hydropower, thus making the electricity supply for Nebraska sufficiently expansible to take care of the State's electricity needs until newer fuel sources are developed.

Nebraska has few energy resources within its borders. Ninety-three percent of its present energy requirements are imported from outside its borders. In the area of transition fuels, however, coal is comfortably located in neighboring states, Wyoming and Montana, to the west. The problem area at the present time, as far as energy supply is concerned, is in oil and natural gas. The giant irrigation industry, based on a plentiful supply of ground and surface water and large-scale returns resulting from irrigation techniques, has sprung up within the State in a comparatively short period of time. Though 38 percent of the deep well pumps are powered electrically the majority of them are dependent on fossil fuels such as natural gas, diesel fuel and propane, with the result that power supplies are threatened in the short run and doomed to possible extinction in this area within a generation. Along with the irrigation revolution there was a rapid increase of vehicles, appliances, and air conditioning units in the pre-1973 years, so that in general the Nebraska energy situation after 1973 was not unlike that of the nation as a whole, having a voracious appetite for energy and a dependence on supplies suddenly becoming expensive and scarce. In the years since 1973 trends in the types of energy used in Nebraska are discernable. In 1973, for instance, 6.4 trillion BTUs of energy were produced by nuclear fission; in 1977 these same sources produced 79.4 trillion BTUs. This tremendous increase, 1130%, did not presage a vaster expansion, however, and an examination of the planning done by the State's two major electricity suppliers reveals that future expansion was revamped to proceed along non-atomic, coal burning lines, with some plans to expand hydropower. Since 1973 there has been a reversal in respect to coal use for electricity generation in Nebraska. Between 1973 and 1977 coal production of energy increased from 32.8 trillion BTUs per year to 46.2 trillion BTU's. This trend will be accelerated as the two plants, one at Nebraska City and the other near Sutherland, that use coal exclusively for electricity generation come into production in 1979 and as construction gets under way in 1980 on a third coal-burning facility.

Of considerable interest from an energy conservation standpoint are two Nebraska Public Power District Proposals: The Mandan Line, a high voltage interconnection by NPPD with Manitoba Hydro in Central Canada for exchange of power, taking advantage of Manitoba's winter peak load to assist in reducing Nebraska's summer peak load; a pumped-storage facility for Northeast Nebraska for which a FERC license has been requested.

Nebraska's Energy

FIGURE 6 **1977 ENERGY SOURCE AND UTILIZATION IN NEBRASKA**



A dam about 650 feet wide and 150 feet high is proposed that would generate electricity during peak summer load. The fallen water will be pumped back up to the lake behind the dam using electricity available but not called for in the off-peak times. Studies of the project have been completed and financial arrangements in the form of about $650 million worth of bonds to be issued by the NPPD are well beyond the planning stage. This development, when considered in addition to the three new coal-burning facilities, indicates that Nebraska's contribution to the national power grid will be adequate to take care of her growth needs in the years ahead.

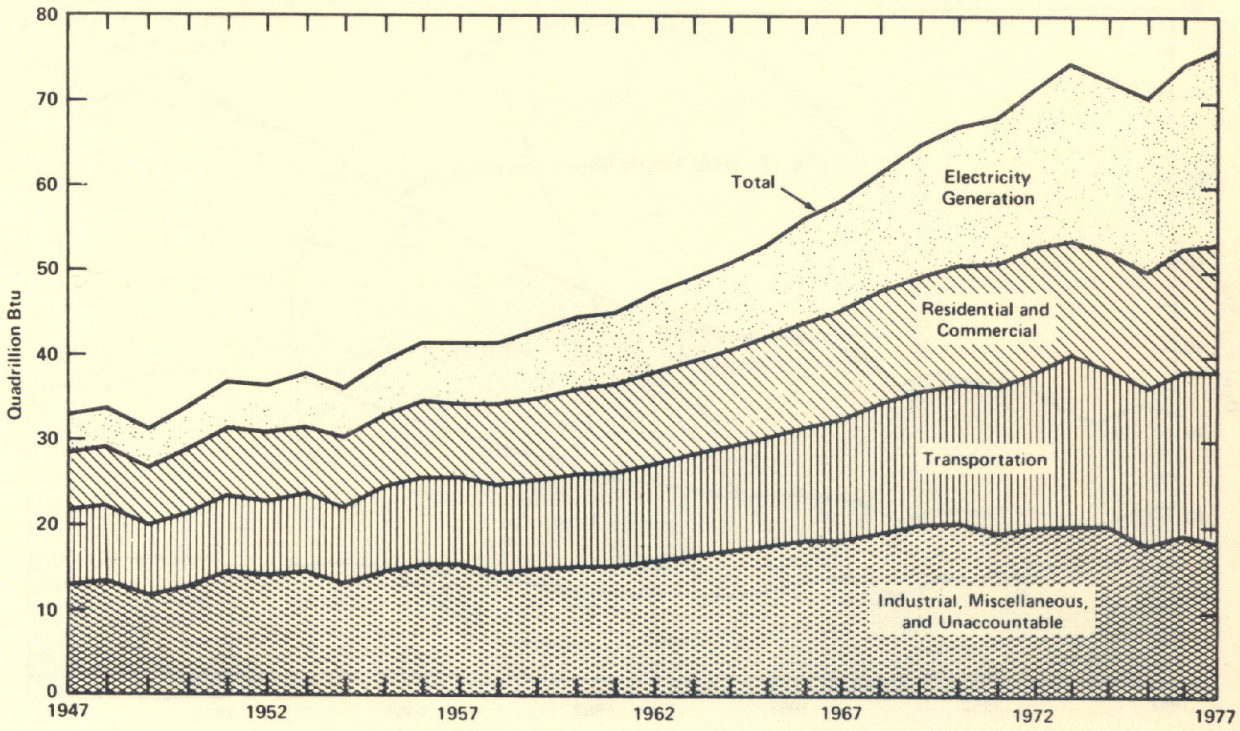
The National Energy Plan calls for a transfer by heavy industry from the use of oil and natural gas to coal. The Nebraska experience has seen the transfer from expanded use of atomic energy to coal for the generation of electricity. As far as Nebraska agriculture goes, however, there is no current pressure to change from dependence upon natural gas, since the various analyses of The 1978 Energy Act do not indicate any short-term lack of natural gas for primary users, of which agriculture is one. The present dependency of Nebraska agriculture on propane and diesel fuel should, for two reasons, gradually abate. First, there is the possibility of expanding the natural gas pipeline system within the state, accomodating the central and north central areas where dependence upon propane and diesel fuel is most predominant. Secondly, there is the distinct possibility that expanded electricity capacity by NPPD could alleviate dependence in the same areas. Even today electricity is used extensively in some areas of the vast Nebraska irrigation system.

Of course, Nebraska will continue under the threat of petroleum shortages, just as the Nation will. The problems in home heating and transportation, since alternative fuels for natural gas in home heating furnaces and gasoline in internal combustion engines are not in satisfactorily developed stages, will continue in Nebraska as they seemingly will for the United States as a whole. In general, however, with good conservation policies and proper planning the energy outlook for Nebraska is not pessimistic. Here again the State resembles the Nation in that the development and commercialization of alternative fuels will be a necessity if hardship from the disappearance of oil and natural gas is to be avoided.

State government involvement in the Nebraska energy problem during the 1973-1977 period followed the same general lines as at the federal level. First, there was direct action under the Energy Emergency Bill, which gave the Governor authority to set up the Nebraska Petroleum Allocation Office. Through this Office Governor Exon dealt with the problem of middle distillate shortfalls in 1973 and the petroleum-related fuel shortages of the 1973-1974 winter. Energy-related activities of this period were accomplished with a good deal of effectiveness in spite of a lack of planning. Late in 1974 a Petroleum Allocations Office, later titled the Nebraska Energy Office (NEO), was set up in the Nebraska Department of Revenue. The manner in which this 1974 establishment evolved into the present NEO will become evident as the National Energy Plan and Nebraska's response to it are described.

National Energy Plan

FIGURE 7
Primary Energy Consumption by End-Use Sector



Beginning with the Arab Oil Embargo of 1973 and continuing to the present, the federal government has addressed the nation's energy problems. The Emergency Petroleum Act of 1973 concerned itself with immediate shortages by creating the Federal Energy Administration Office and the federal-state set aside program. Additional legislation in 1975 and 1976 established state energy conservation activity and the weatherization program. Finally the recently-passed National Energy Act of 1978 created a comprehensive approach to stem the rapidly-depleting petroleum fuels and gave tax incentives to help Americans switch to other sources of energy.

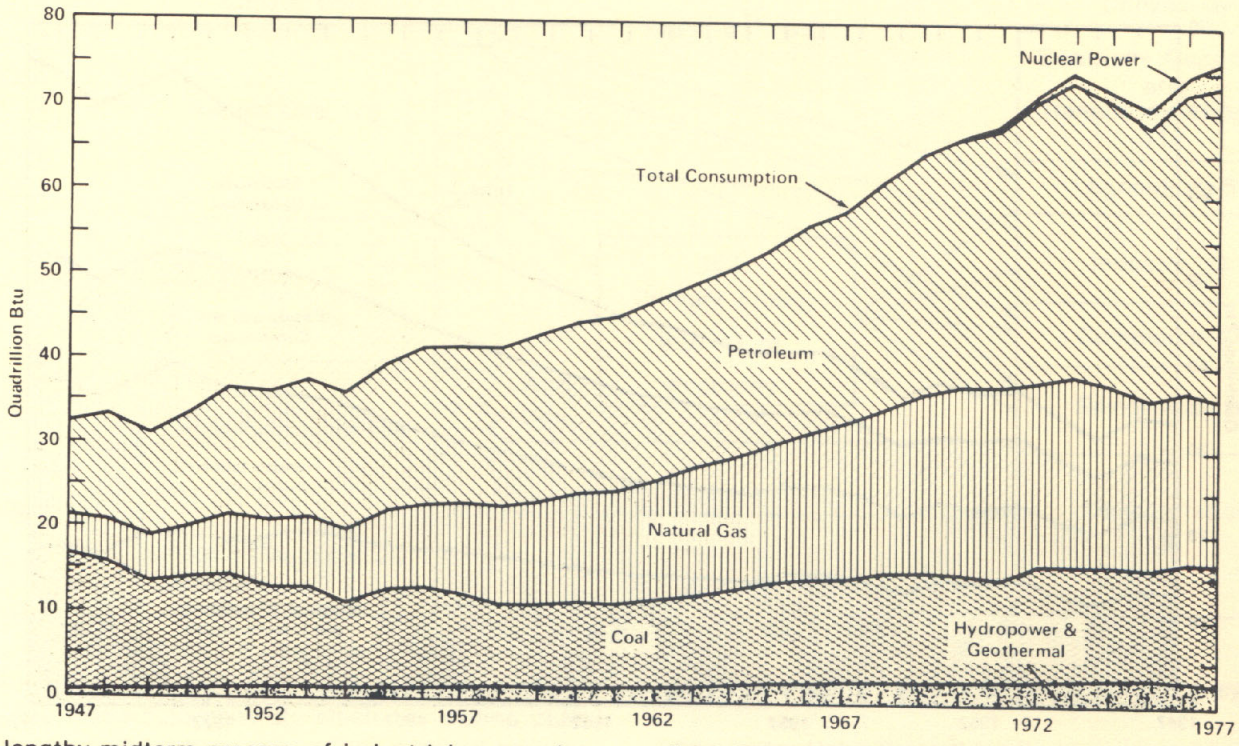
The essential thrust of these legislative activities in the Congress and the actions in the executive branch was given in a lengthy review of the total problem presented by President Carter on April 29, 1977 and entitled The National Energy Plan. As outlined by the President, the Plan has three principal objectives: First, reduce American dependence on foreign oil; second, rearrange our industrial installations to provide a means of coming through the dwindling reserves and supplies of petroleum-related energy sources without danger to the nation's well-being; third, and in the long run, to develop renewable and inexhaustible sources of energy to support future growth.

In order to reduce dependence on foreign oil, conservation on a large scale was called for. The aim was not to eliminate foreign oil completely, in the short run. The aim was economic, in that the market for petroleum had to be changed in its demand-supply aspects; that is to say, the sellers' market that gave the OPEC nations such a dominant position and enabled them to increase oil prices by 400 percent in a short period of time had to be mitigated if a weak buyers' position were to be avoided in the future. Conservation would bring some semblance of balance to the demand-supply situation and keep future prices within some limits. By being in a position of less need though not of complete physical independence of foreign oil, the threat of unreasonable price rises and embargoes would be diminished. Conservation on a massive scale was the key to a good short term policy. The changeover in industry and on the farm from natural gas and petroleum products to coal and electricity produced without oil or natural gas was a medium term strategy, while a build-up of a strategic oil reserve could prevent some of the consequences of sudden stoppages of imported crude oil and give the nation breathing space until this large-scale industrial and agricultural conversion could be accomplished. This strategically stored oil, at first planned for a four billion barrel figure but later reduced in the planning stage to one billion barrels, could hold domestic supplies in reserve in order to establish priorities in energy use should some catastrophe place the foreign crude oil out of reach, with obvious consequences to heating and transportation needs of the American public.

FIGURE 8

The National Energy Plan

Energy Consumption by Primary Energy Type



The lengthy midterm process of industrial conversion from petroleum and natural gas to other fuels, involving changeovers of huge dimensions, is restricted in scope by psychological considerations that hamper expansion of fission-derived energy through the extension of existing reactor technology and innovative steps in breeder reactor development. Other fears compounded the difficulties in the atomic energy area, since terrorist activity on a global scale has increased the fear that fission-based energy production, with substantial amounts of waste in the form of such materials as plutonium, evoked the specter of these materials falling into the hands of a radical group. Because of the factors just mentioned, the time scale of the National Plan was altered to some extent.

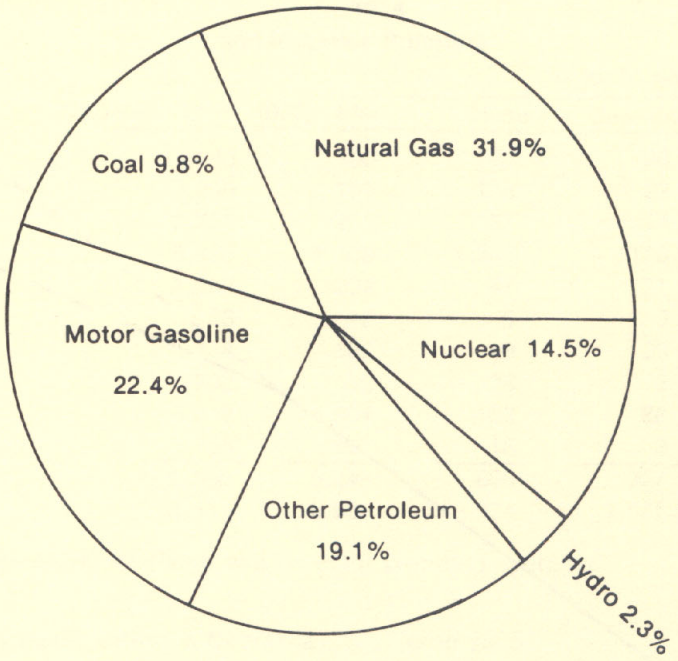
The Energy Policy and Conservation Act of 1975 provided for a system whereby state energy offices were integrated into the National Energy Plan. These state offices, although assumed to be engaged in projects involving long-term matters such as research, were given major conservation tasks, the nature of which will be investigated later in this report. This emphasis on conservation was carried into the 1976 legislation, the Energy Conservation and Production Act, which extended the areas of conservation work by the state offices and added the Weatherization program. The latest energy legislation, the 1978 Energy Act, however gives attention to the solar program in a context of intermediate, rather than long-term goals. On May 6, 1978, for instance, President Carter called for a new and accelerated effort in the solar energy field. The Solar Coalition, a group of 100 members of Congress motivated by the view that an accelerated solar energy program at the national level could make it possible for solar emplacements to care for as much as 30 percent of the nation's energy needs within 10 years, has backed legislation to increase competitive ability of these solar devices both in financial and improved engineering aspects with the aim of gaining widespread acceptance of them, especially in homes, farms, and small enterprises. In 1978, then, a continued effort in conservation and weatherization was called for by the National Energy Plan, and expanded solar commercialization programs through such projects as Mid-American Solar Energy Center (to be discussed later) and increased funding for research and development of fusion reactors were proposed.

One aspect of the National Plan that is innovative, is the use of state offices as primary instruments in the operation of federal programs. This is not a unique situation in that a number of federal departments and agencies intermingle state and federal funds in carrying on agricultural, industrial relations and other programs. However, by making the state energy offices its officially-designated representatives in many of its federally financed programs, the U.S. Department of Energy has carried this device to a more significant degree of application. This has, as will be shown later in the report, significance for the role the NEO seems destined to play in Nebraska's response to energy problems.

The Nebraska Energy Conservation Plan

FIGURE 9

Relative Input of Various Fuels Nebraska 1977



With the publishing of the Energy Policy and Conservation Act of 1975, P.L. 94-163, the Nebraska Energy Office began a preliminary study of the Act and its effect on the Nebraska energy and conservation situation. In April, 1976, a report to the Governor recommended tentative participation contingent on the outcome of the Federal Energy Administration (FEA) rulemaking required by the Act. The Governor responded to FEA by letter indicating his intent to participate, but expressing his concern for matters left unclear or undetermined by the legislation.

A study of the feasibility for Nebraska to make the projected energy saving of 5 percent by the target year 1980 was then begun. In addition to studies conducted in the Nebraska Energy Office itself, the opinion of the University of Nebraska was sought. The material most centrally relied upon was "An Appraisal of Energy Utilization in Nebraska," prepared by the Director of the Engineering Extension Service, University of Nebraska, and sponsored by the Nebraska Petroleum Allocation Office, as the Nebraska Energy Office was known at the time. The data collected and presented by the document was Nebraska's entire energy budget for calendar year 1973. The study showed the State of Nebraska to be dependent for 94 percent of its energy needs upon fuel sources outside the State. The sectoral breakdown of energy use focused attention for the first time on the end uses of fuel and power.

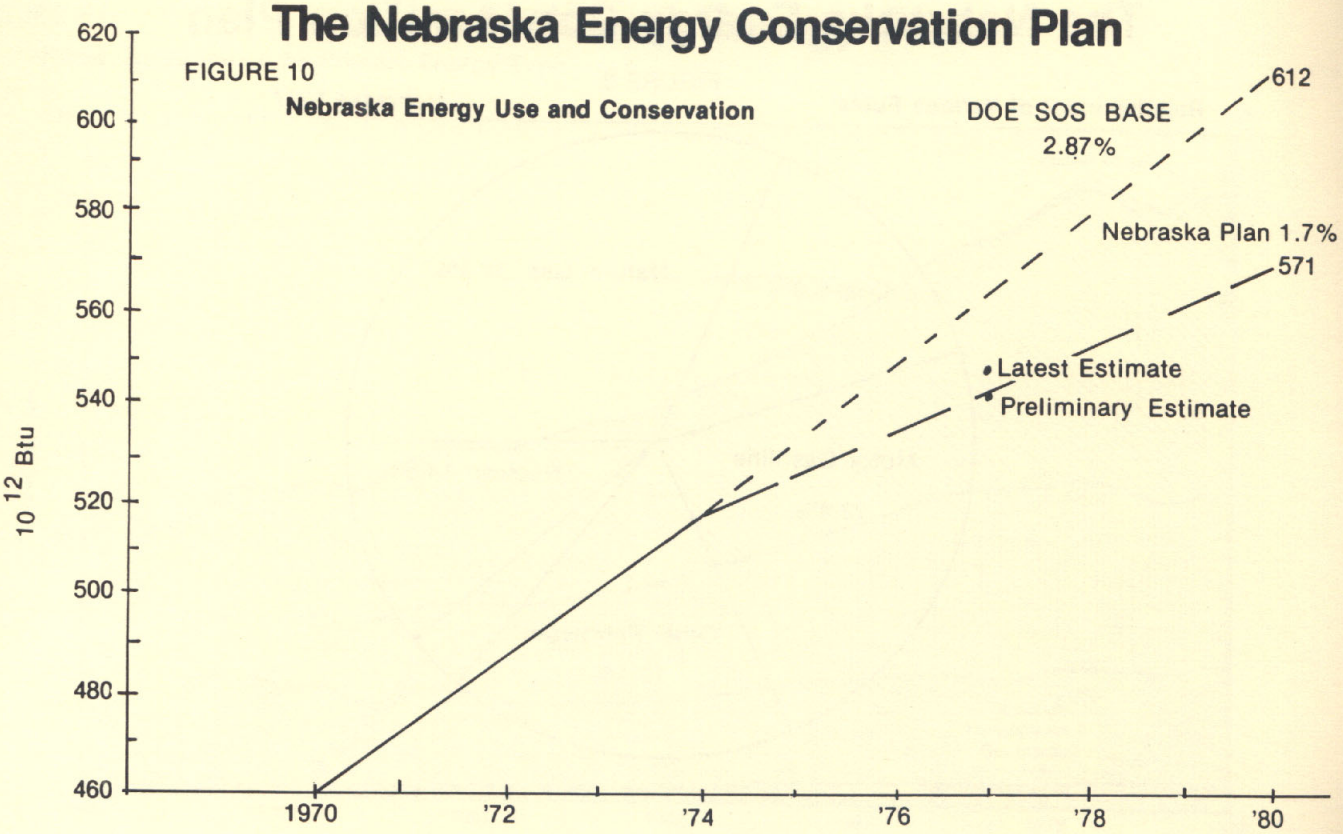
Discussions between the University and the Nebraska Energy Office brought the conclusion that, were the FEA guidelines reasonable and the scope of the state-specified programs sufficiently broad, the State could profitably participate in the Energy Policy and Conservation Act (EPCA) program. It was felt that Nebraska should enter the planning phase for which separate federal funding would be provided, regardless of later considerations within the State that might dictate opting out of the implementation stage of the program.

The need to develop a comprehensive Nebraska conservation plan was the prime motivation in Nebraska's declaration to participate. A strong secondary impetus was the clear opportunity to state Nebraska's needs and concerns before federal mandates and national priorities overshadowed them. Most specifically, the State's concern for an adequate future fuel supply and the need to maintain a high priority for Nebraska's extensive agribusiness interests spurred the study. The decision was made early to include a state emergency contingency plan in the conservation program so that future energy emergencies could be met quickly in an organized and efficient manner.

The Nebraska Energy Office prepared the necessary feasibility report in August, 1976. Because the final FEA guidelines had not yet appeared, the report was, of necessity, very general in its description of programs. While reference was made to meeting the mandatory requirements and suggesting conservation projects for the State that roughly coincided with

FIGURE 10

Nebraska Energy Use and Conservation



FEA's draft guidelines, the feeling was very strong that a plan was needed that met specific State situations and requirements regardless of the directions that federal funding would go.

To prepare the State for the extremely detailed statistical analysis and reporting that would be required even under the planning portion of the Act, the Nebraska Energy Office contracted with John W. Cook and Associates, Inc., of Chagrin Falls, Ohio, to prepare a work plan for the conservation Plan. This work plan was completed in late August, 1976, even though the final FEA guidelines did not appear until October 25, 1976. The data base for the State was assembled as a cooperative effort between the Nebraska Energy Office and the University. Negotiations between the State and FEA regarding discrepancies in federal and State statistical projections for Nebraska's energy use in 1980 were carried forward successfully.

In the next phase, committees of selected representatives of State agencies and other organizations who were generally responsible for and knowledgeable about the energy supply and demand situation in the State met to consider the plan. These representatives had a brief opportunity to express themselves on specific details of the plan. They offered specific suggestions regarding the plan formulation, and on matters relating to its implementation, enforcement, and measurement of effectiveness.

Nebraska Energy Office staff and the UNL Engineering Extension Service cooperated in writing the 20 measures mandated by the FEA or recommended by the advisory committees. The use of the FEA's projected Nebraska energy consumption for 1980 at 612 trillion Btu provided a standard against which all anticipated energy savings could be measured. The Plan as written called for a 5.8% reduction in energy use in the State by 1980.

The Energy Consumption and Production Act of 1976 (ECPA) extended the scope and funding of state conservation plans to include intergovernmental coordination, energy audits of buildings, and programs of energy education. A separate section of the Act created a Weatherization program for low-income, elderly, and native Americans and a separate State Plan was developed for this project.

An energy savings goal of 0.9% of the projected 1980 Nebraska consumption was established for the supplemental State Plan. The total energy savings goal for the two plans, therefore, totals 6.7% of the 1980 projection, or 41 trillion Btu.

All three State Energy Conservation Plans, the base plan under EPCA, the supplemental plan under ECPA and the Weatherization program were approved by FEA in September, 1977. Funding for all of these Plans has continued since that date.

The Kansas-Nebraska Agricultural Energy Program

FIGURE 11

Great Plains Irrigated Cropland Acreages
1974
and Irrigation Pumping

	Irrigated Acres (000)	Acres Irrigated in Thousands (000)*				
		Elec.	Diesel	Gasoline	Nat. Gas	LPG
Colorado	3,140	1,100	100	20	330	100
Kansas	2,360	169	138	22	1,792	183
Montana	2,231	271	37	14	0	3
Nebraska	5,338	1,308	1,360	118	637	1,331
New Mexico	1,062	204	47	31	484	54
North Dakota	78	42	9	3	0	1
Oklahoma	738	102	49	20	435	113
South Dakota	202	52	36	8	0	37
Texas	8,618	1,904	102	88	6,307	395
Wyoming	1,798	191	18	3	7	6
GREAT PLAINS	25,565	5,343	1,896	327	9,992	2,223
UNITED STATES	51,719	15,621	3,934	1,071	10,635	3,338

* Includes limited acreages involving two types of pumping systems.

An early effort toward energy conservation in Nebraska involved a cooperative project called the Kansas-Nebraska Agricultural Energy Program. Representatives of the Kansas and Nebraska Energy Offices expressed interest in a mutual project to determine energy-conserving techniques that could be applied to production agriculture. Both states consume between three and four times the national average of energy used for farm operations and both had experienced seasonal fuel shortfalls involving diesel products for irrigation and fuel oils for home heating.

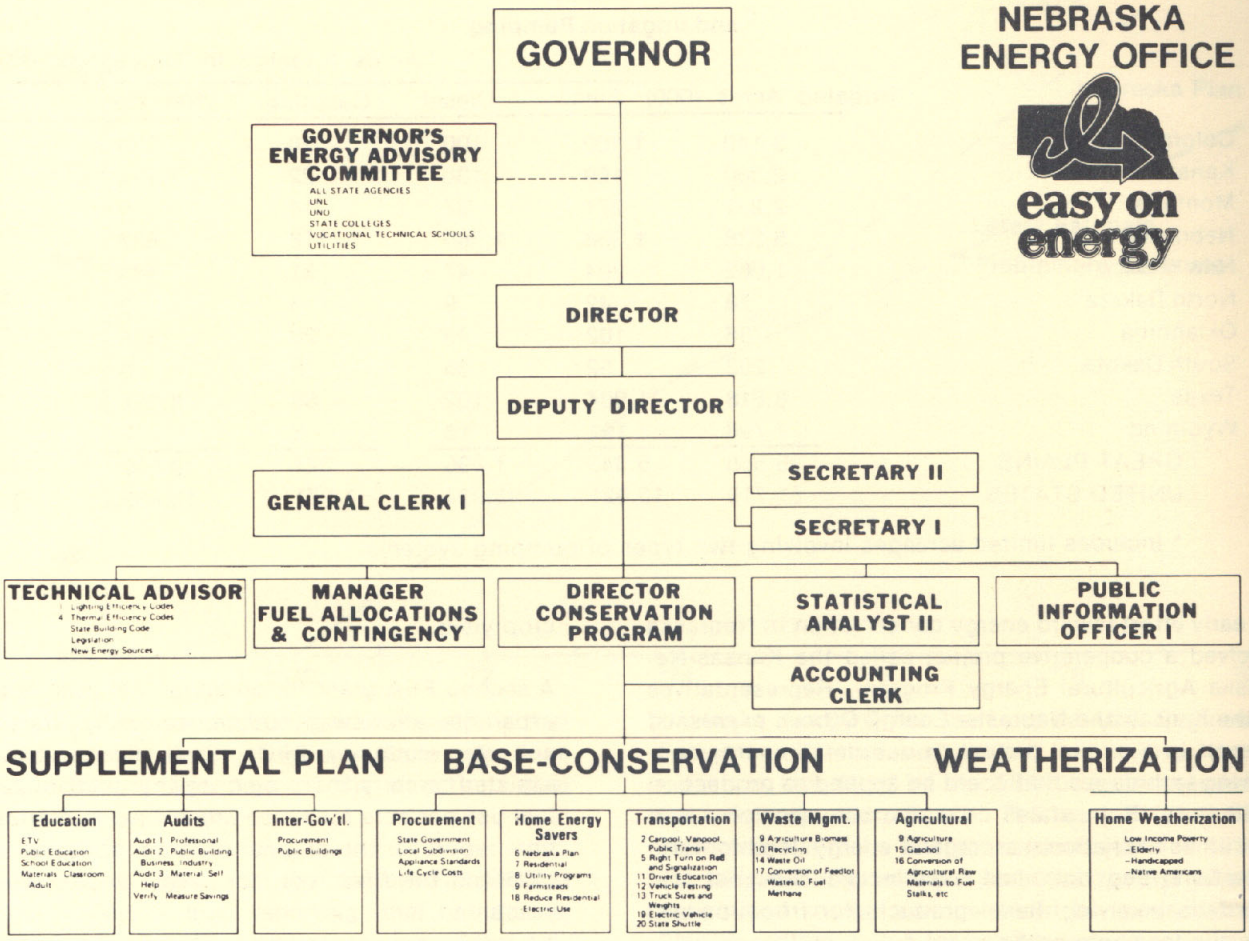
With the help of the Federal Energy Administration, Region VII, Kansas City (now the U.S. Department of Energy), both state energy offices pursued federal funding for the proposed project. An FEA grant was provided in 1976 and the work was performed by the Departments of Agricultural Engineering at Kansas State University and the University of Nebraska. The state energy offices were the formal grant recipients, and federal funds, periodic reports and subsequent grant requests were processed through these same offices. More than one hundred farmers in each state, chosen for diversity and geographic spread by county extension agents of the Cooperative Extension Services, participated in the project. Thirty-three counties were included in the Nebraska sampling. The fuel use on each farm was metered at both farm tank and tractor. Detailed records were kept of the operations and the fuel used in connection with them. Analysis by Agricultural Engineering staff in both states identified operational areas of unusually high fuel use and testing of alternative irrigation and field techniques yielded conclusive evidence that significant energy savings could be effected without a reduction in crop yield.

A second FEA grant for an additional year of program experimentation was supplemented by state funds, and the emerging EPCA State Conservation Plan assisted to carry the project to the point of reporting fuel use per acre for all common field operations. The final report for the original program appeared early in 1978 and the final fuel use survey should emerge at year's end.

Both states enjoyed excellent farm response and both projected energy savings of $20.00 for each dollar spent in the program. Nebraska was uniquely equipped to employ data for a wide range of agricultural benefits. Agricultural engineering and extension services personnel provided on-the-farm attention to specific problems such as evaporation from fuel storage. Program advisors also employed statistical comparisons through the use of AGNET, a network of computer terminals created by the Western Governors' Conference with Old West Region federal funds and located in each of the counties where the sample farms were examined. Thus, it was possible to analyze energy use as actually recorded by the farmer and compare the data for such use in unidentified neighboring operations. The friendly relationship enjoyed by the farmers, the University, and Cooperative Extension personnel enabled the program to progress rapidly and the analysis available through the network made the results of energy measurement promptly available to the farmer, thus insuring sustained interest and cooperation in this entirely voluntary program.

NEO Organization

FIGURE 12



The Nebraska Energy Office Organizational Chart represents the structure created by the Director after his appointment on September 16, 1977, with approval of the Governor's Advisory Committee and with positions classified and authorized by the Nebraska Department of Personnel. The Chart shows the positions and program categories as they existed on January 1, 1978.

The Governor's Energy Advisory Committee was established by executive order December 23, 1976. Its membership was composed of the Lieutenant Governor, the State Tax Commissioner (who is also the State Energy Coordinator), and the heads of selected State agencies, plus the Director of the UNL Energy Research and Development Center.

The Educational Coordinator is the liaison person for matters involving the State Department of Education, the Nebraska Educational Network, and other educational groups and programs. For contact and publicity arrangements with State agencies, utilities and cooperating organizations, NEO staff members are designated for specific operations.

Additions to the statistical and budgetary staff occurred in 1978; the first to aid the Statistical Analyst II in preparing operations research papers for the annual report and to aid in preparing the winter energy emergency contingency plan, the second to fulfill the multitude of financial reporting services required by the United States Treasury under the Federal Grants process and to prepare for several additional grant programs to be created by July, 1979. The remaining elements of the Organizational Chart will be explained as the programs of the Office themselves are described in those sections of this report that follow immediately. It should be noted that the Director and his Deputy manage the allocations and contingency operations, whose manager reports directly to them, and the energy inventory. The energy conservation programs are under the management of the Director of those operations.

Petroleum Allocations and Contingency Planning

FIGURE 13 **APPLICATIONS AND ALLOCATIONS**
1976

	Applications	Allocations Gasoline	Allocations Middle Distillates	Allocations Propane
January	633	256,472	288,050	-0-
February	561	247,994	290,646	12,000
March	580	464,132	459,511	184,541
April	489	754,902	448,027	8,500
May	442	1,470,202	730,886	80,226
June	479	1,614,546	737,523	115,638
July	596	1,425,663	1,290,720	341,200
August	571	-0	989,815	329,630
September	528	694,083	396,358	102,000
October	465	663,049	222,436	188,998
November	511	695,412	499,666	107,200
December	407	756,657	591,168	164,144
	6,262	9,013,112	6,934,704	1,634,077

Grand Total Requests 1976
6,262

Grand Total Allocation 1976
17,581,893 gallons

The first energy activities undertaken by the Petroleum Allocation Division, Nebraska Department of Revenue, were those concerned with emergency allocation and contingency planning. The shortfalls of the 1973-1974 winter led to a set-aside program. This involved the designation by the primary producers of three percent of their monthly totals of distillate products and four percent of gasoline. These amounts were to be used by the allocations staff to relieve distressed jobbers and consumers in situations of shortage that threatened to produce hardship. Presently the Manager of Petroleum Allocations, acting on the authority given by the Governor to the NEO, makes the judgment as to the extent of the shortage and its potential hardship. The Manager then releases the product with the approval of the Director to relieve the situation by releasing the set-aside amounts to insure jobbers and consumers of some energy source. Although mandatory allocation and the control of price of middle distillates (diesel fuel and heating oil) was discontinued by order of then-President Ford in July, 1976, the set-aside program still continues as a major activity of the NEO through 1978.

Allocation activities focus specially on those areas of seasonally fluctuating demand such as gasoline peak consumption in summer and intense diesel and LPG use during the planting and harvesting seasons. Figure 13 gives sample data for 1976 in propane, middle distillates, and gasoline to demonstrate the nature of allocation activity. The 6,262 requests in 1976 resulting in an allocation of 14,622,895 gallons of fuel, show clearly the volume and continuing need for hardship alleviation.

Contingency planning within the State was, under direction of Governor Exon, performed by the Nebraska State Office of Planning and Programming and the State Civil Defense Agency. A general emergency analysis for State government in Nebraska was completed in March, 1978. Entitled "The State of Nebraska Resource Crisis Management Study", it was distributed to the Chief Executives of the State's political subdivisions and to the heads of all State departments, agencies, and offices, as well as to all Civil Defense directors.

This study developed a plan for action. The Governor, on being advised of an emergency, would notify a newly-created body, The Nebraska Resource Crisis Management Board. The Board, through its Manager would be notified of the impending crisis and call for suggested counter-measures. The Board, after obtaining necessary information, could make a judgment with respect to recommendations to the Governor. The Board would depend on agencies and State authorities in various fields. In the energy field the Director of the NEO would be expected to use his computer-based store of information to provide quantitative answers to the various solutions that could be implemented. The effects of optional solutions could be modeled by computer before the Governor was advised of the best course of action in the situation. In the last part of this report an account is given of future planning for NEO operations, and there it will be shown how this kind of capability in the NEO will be integrated into the new energy emergency monitoring system being constructed by the DOE for the nation as a whole.

Energy Inventory

FIGURE 14

1977 NEBRASKA ENERGY CONSUMPTION BY SOURCE AND SECTOR

10^{12} Btu

	Electric Utilities	Residential	Commercial	Industry	Agriculture	Transportation	Total	Percent
1. Coal	46.2		0.7	7.			53.9	9.8
2. Natural Gas	15.5	52.6	37.3	54.0	12.4	3	174.8	31.9
3. Motor Gasoline			0.5		4.6	117.6	122.7	22.4
4. Aviation Fuel						5.6	5.6	1.0
5. LP Gas	2.0	10.5	1.4	2.5	7.2	0.2	23.8	4.4
6. Other Petroleum	5.9	8	10.2	5	21.7	24.2	75.0	13.7
7. Nuclear	79.4						79.4	14.5
8. Hydro	12.7						12.7	2.3
Electricity (Sales)	42.6	14.9	14.4	8.0	5.3	--	NA	
Total	119.1 (losses)	86.0	64.5	76.5	51.2	150.6	547.9	100%
Percent	21.7	15.7	11.8	14.0	9.3	27.5	100%	

NOTE: Because of lack of original data and differences in reporting methodologies, a further revision is possible.

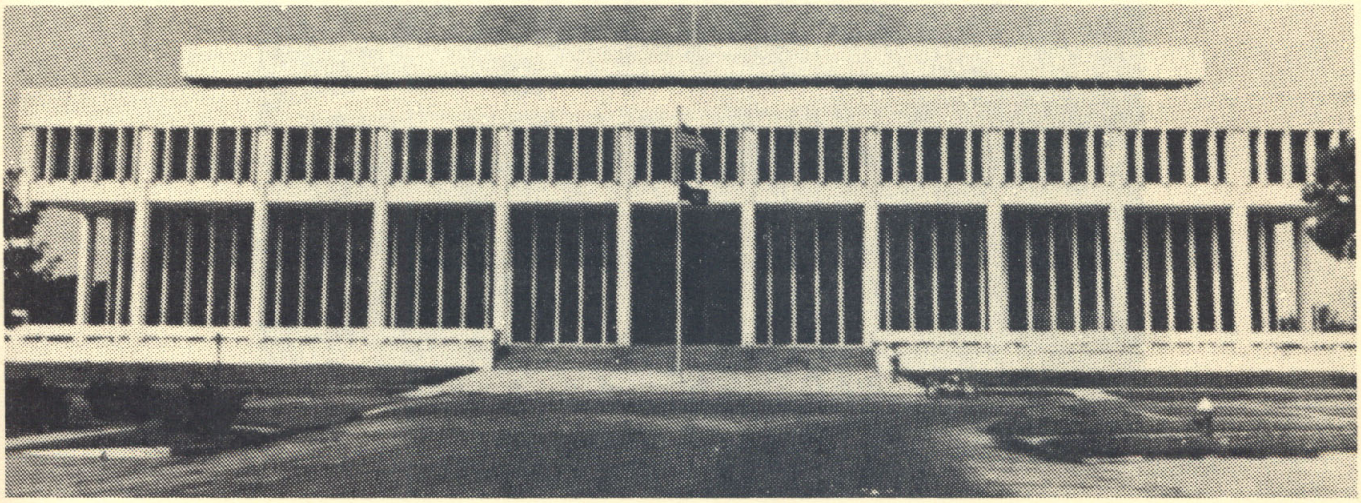
In December, 1974, the author of an analysis of the Nebraska energy situation for calendar 1973 published by the Engineering extension Service of the University of Nebraska for the Petroleum Allocation Office complained of a lack of basic and particular information about energy in the State. What the analysis had in mind was a situation that is commonly found in the various states, namely that, while total supplies of energy present in a given state and available to its citizens in general is ascertainable through information from the carriers and large-scale suppliers, particularization of these total figures is more difficult. Thus, in Nebraska it is possible to summarize total inputs of electricity, natural gas, and so forth used in the State during a given period, but the determination of where and by whom these resources are consumed within the State's borders is more complex. The problem has been caused in part from the fact that national energy data from the DOE is disaggregated for geographical location by the use of mathematical formulae. In such a case the totals for a given state are probably accurate, but the elements that go into such formulae are subject to revision that might result in incorrect information, as seen in some cases where emergency shortages could not be remedied for lack of precise information about the whereabouts of substitute supplies. One of the chief tasks of the statistical section of the NEO is to remedy this weakness and to create reliable Nebraska energy data.

The Energy Inventory is a direct result of the Nebraska Energy Conservation Plan in which the FEA/DOE data base for energy utilization was established. The nine files containing totals of the various fuels used in the base period are continually updated as information on the fuels becomes available. In order to pinpoint the localities and types of consumers of each fuel used in the State a private consulting firm was called in to direct NEO personnel. The State was divided into ten areas and the computer program breaks down the statewide totals into their smaller geographic components, thus separating the totals into the various kinds of consumers---residential, commercial, industrial, agricultural and so forth. This task is not complete at present, but progress toward the goal of complete accuracy in this matter has been made and the work continues.

Some idea of the Energy Inventory operation can be obtained from Figure 14. In its efforts to determine the type of consumer of each fuel the NEO statisticians depend more and more on their own inquiries to suppliers. The NEO staff is also engaged in analyzing the results of certain conservation programs in Nebraska. An instance of this is the effort now in progress under the direction of the Building Audits Coordinator to estimate the effectiveness of the energy audits performed on approximately 450 commercial buildings in Nebraska during the past three years. NEO statistical personnel are able to give good estimates of the amount of energy savings brought about by this program in the State. Other NEO programs have not as yet been in operation for a sufficient length of time to warrant such an analysis, but these will be subject to this type of critical review in the future. In conclusion it might be stated that NEO energy data collection succeeds in accomplishing three principal tasks: updating the energy base; pinpointing exact areas where the various fuels are consumed in the State; and, finally, providing the data needed to give proper adjudication of the effectiveness of NEO programs, especially in the energy conservation field.

Intergovernmental Coordinator

FIGURE 15



The Energy Policy and Conservation Act of 1975 (PL 94-163) mandated five specific measures, while the Energy Conservation and Production Act of 1976 (PL 94-385) required three additional areas of conservation attention by state energy offices that chose to cooperate in federally funded programs. The Intergovernmental Coordinator of the NEO has in his charge the performance of projects aimed at fulfilling three of the required programs, namely, the establishing of thermal and lighting standards for Nebraska, the adoption of energy-saving procurement policies by the State itself and by its political subdivisions, and coordination of energy projects by governmental agencies in the State. The Intergovernmental Coordinator assisted in promoting legislation to establish a code for thermal and lighting efficiency. Although LB 820 was introduced to the 1978 Unicameral Executive Committee of the legislature and supported by the State Housing Advisory Council it failed of passage. A new bill, prepared by a subcommittee of the Unicamerial's Health and Welfare Committee with cooperation from the NEO, will be introduced in the 1979 legislative session.

By law most substantial purchases by State government are made through the Nebraska State Purchasing Agent's Office on an open bid basis. The most dramatic example of the use of the bid system by the State Purchasing Agent to produce energy-efficient results is in the purchase of the 1978 State auto fleet vehicles, in which modified life-cycle-cost estimates were required from prospective bidders. The Intergovernmental Coordinator has monitored 60 of these activities with an eye to extending State energy savings by using similar techniques on other classes of purchased equipment by both State and local government purchasing agents. An executive order will be sought in early 1979 to extend present purchasing patterns that promote energy savings.

Intergovernmental activity in promoting energy conservation is growing on a community-by-community basis as local groups seek literature, technical assistance, and funds for locally created energy programs. Cooperative work with the Nebraska Community Improvement Program (under the Department of Economic Development, Community Services Division) and the employment of a University of Nebraska at Lincoln graduate student intern for public planning has allowed the NEO to plan numerous demonstration projects for Nebraska communities in the fall and winter of 1978. Local efforts to promote efficient use and conservation of energy in homes, farms, and commercial and industrial operations are at the heart of these proposed projects. Coordination with the Otto Hoiberg community award competition (to be presented in late 1979 for energy projects) allows the NEO to reach a far larger field of community participants than can be served through solo but duplicative services.

Since the 1978 National Energy Act requires the DOE to give life-cycle-cost information on a number of specified appliances and in view of the fact that the governors of states are requested to inform the public of dealers able to supply energy-saving devices to the general public the Intergovernmental Coordinator will be a resource person within the NEO to assist the Office in its role of advisor to the Governor of Nebraska in his efforts to place this information in the hands of the public at large.

Building Energy Audits

FIGURE 16

LOCATION	RESIDENTIAL	COMMERCIAL
LINCOLN (NE)	600	
LINCOLN (Uni Place & Near South Neighborhoods)	5,300	
OGALLALA	2,300	
WAVERLY	400	
STATEWIDE		450
TOTALS	8600	450
GRAND TOTAL	9050	

Energy audits of buildings are the oldest NEO conservation program in point of time. Begun in the summer of 1975 as the Nebraska Plan for commercial buildings, the projects used engineering students in the employ of the Engineering Extension Service at UNL to evaluate buildings identified by cooperating utilities as needing assistance.

This program continues as a permanent part of NEO operations, and because the techniques of the project have proved successful, they have been integrated into the NEO energy conservation programs. At the recommendation of the NEO Building Audits Coordinator, engineering students of the University of Nebraska visit buildings whose occupants express a wish for an energy audit and do a preliminary survey. The building is examined for energy conservation efficiency, both as to techniques of operation and materials. An estimate is then made according to formulae developed by NEO and University of Nebraska personnel of potential savings that can be achieved through procedural and materials changes. After the preliminary findings have been overviewed by the Audit Team, a final estimate of savings is made and given to the occupant together with a list of proposed operational and material changes. The savings estimate is made in both dollar and Btu terms. After a period of time, the building is revisited and the actual changes brought about as well as the amount of energy saved by such changes are summarized in discussions between the occupant and the examining engineers.

The other programs of the NEO in the buildings audits field follow this same general methodology. Later programs of the Building Audits Coordinator have developed a rapid survey method, especially in the residential field, where a given home can be analyzed with the help of computer orientated techniques. In effect, a given residence, once its dimensions and construction materials are known, can have its energy costs estimated on a hyopthetical assumption that its operation and materials situation are optimum. This is a cost estimate in dollars. This figure is compared with the occupant's actual heating costs and the difference represents the savings that can be made if improvements are put in place. Because of the rapidity of this analysis the motivation for the occupant to make desirable changes is increased, as the information comes at a time of great interest in these matters.

The 1978 Energy Act provides funding for state offices to undertake complete and statewide programs for building audits of schools and hospitals. This is a three-year program consisting of preliminary audits, technical assistance, and in-place conservation. Because of the four years of experience with the Nebraska Plan and other building audits, the NEO expects to be heavily committed to this huge task. In view of the large potential for energy savings in these institutions and the high level of cooperation that can be expected from those in charge of them, the prognosis for this particular program seems excellent.

Table 16 shows the various totals of the projects carried on under the direction of the NEO Building Audits Coordinator.

Transportation

FIGURE 17

Previously in this Report, it was mentioned that two of the measures mandated by federal law for state energy offices participating in the EPCA (P.L. 94-163) were promoted by the Transportation Coordinator. These are a program calling for regulation permitting motorists to turn right after stopping for a red traffic light and efforts to promote vanpools and carpools. The first goal (RTOR) had already been attained in Nebraska since 1973. The other, ridesharing by means of car and vanpools, requires heavy subsidization and promotion. Since privately organized carpools and vanpools have faced a struggling existence for some years in Omaha and Lincoln, the only two metropolitan areas of the State, University of Nebraska scientists are presently doing a study, independent of NEO operations, of mass transportation in rural areas, and this could possibly result in an active organization of vanpools and carpools beyond the metropolitan areas, in which case the NEO Coordinator would add actual operational work to the existing promotion by advertising.

In October, 1978, the NEO began operating a shuttle bus for employees of the State between Lincoln and Omaha. Because of the large number of State employees traveling from Lincoln to Omaha on State business, it was thought that a shuttle bus between the points would eliminate a number of cars from the road and save energy. A feasibility study carried on by the NEO in cooperation with UNL, the Nebraska State Transportation Service Bureau and the Nebraska Department of Motor Vehicles showed that such a hypothesis had a solid factual foundation.

Using Department of Energy funds the NEO in a joint effort with The Nebraska Department of Education has introduced, on a pilot basis, energy related audiovisual materials into the Driver Education program currently offered to High School students by 100 Nebraska School districts. As a part of this pilot the teacher training institutions in the state received this material as did the Educational Service Units around the state. This distribution further facilitates the work of energy conservation.

Also cooperating with the NEO has been the Nebraska Highway Safety Program which has added energy related units to the Defensive Driving Course. This course is mandatory for all state personnel and encourages energy conservative driving techniques by state employees. Joint efforts by the NEO and the Highway Safety Program also are promoting the use of the Defensive Driving Course as a court option for highway adult offenders.

The Transportation Coordinator has also made efforts to have such energy conservation aids as proper functioning emission controls and satisfactory motor tuning promoted through motor vehicle safety checks in Nebraska.

An energy-related transportation problem of special significance to Nebraska is found in unit coal train movement that has been increasing in the State during recent years. It has been estimated by the United States Department of Transportation that one of these 100-car trains will be passing some 50 Nebraska towns and cities at the rate of one every 17 or 18 minutes. There are obvious disruptions by reason of this growth. In cooperation with the Nebraska State Department of Economic Development, which is doing a federally funded study of the socio-economic effects of this phenomenon, NEO staff have monitored the situation from an energy-related point of view. Obvious occasions for fuel waste are present in the lengthy waits in many Nebraska communities where coal trains are slow in passing the grade crossing.

Education

From the start of its activities, the NEO has been engaged in the broad field of energy education. The establishment of March as Energy Conservation Month in 1976 for Nebraska and the promotion of Sun Day in May, 1978, are examples. With the establishment of a separate position for education within the Office in March, 1978, a multi-faceted energy education program was initiated.

At the elementary level (K-6), an energy education pilot program was developed. The core material used in the program originated in Iowa; however, the Education Coordinator rewrote the material, entitled Energy Conservation Activity Packets, to make it specifically applicable to Nebraska. Twenty-five school districts were orginally contacted to participate in this statewide pilot program. The only requirement placed on the districts was that their professional staff attend a day-long in-service program held at five sites during June and July, 1978. The State colleges and the UNL Teachers College assisted in holding these training sessions. As part of the pilot, personnel from the State colleges have been subgranted funds to assist the Education Coordinator in the monitoring and evaluating of this energy education material.

As a result of the widespread acceptance of the elementary packets, the pilot has grown to over 30 school districts encompassing more than 6,000 students.

At the secondary level (7-12), a series of 14 mini units dealing with energy education, entitled Basic Teaching Units Energy (BTU's) were developed at jointly-sponsored Energy Institute. The co-sponsors of this Institute were the Nebraska Energy Office and the UNL Teachers College. Thirty secondary social and natural science teachers attended the three-week institute and produced this original curriculum material. The units were edited, printed, and distributed under the co-direction of the Education Coordinator and the UNL Teachers College Science Education section. The BTU's on Energy are currently being field tested in 40 school systems around the State. At the completion of the pilot phase, the material will be evaluated and revised for statewide distribution during the 79-80 academic year.

In the field of adult education, the NEO Education Coordinator and the Nebraska Educational Television Network are producing a series of television documentaries for adult viewing in the State. The first, devoted to solar energy, is in the final production stage and will be aired on the 9-station NETV network early in 1979. Future programs to be produced in the series will address nuclear energy, wind and biomass energy production, petroleum, natural gas and gasohol.

among other energy sources and problems facing the State.

The Nebraska Energy Office, in cooperation with the UNL Extension 4-H division, is developing a 4-H Energy Project. Upon completion of this project, there will be complete sets of material for three different age groups served by 4-H Clubs. Currently, the writing of the manual has been completed for ages 9-11. Two succeeding manuals are in the writing stage. The entire project will be operational by the fall of 1979. In addition, using DOE funds and in conjunction with the Iowa and Missouri Energy Offices, the Nebraska Energy Office is developing a series of four one-half hour energy television programs for 4-H children for the four states in the Midwest region. This series will be produced and available in 1980.

Throughout the curriculum development portion of the energy education program, the Nebraska Department of Education has provided assistance and cooperation. One example was the participation by the Education Coordinator in a series of statewide workshops sponsored by the Nebraska Department of Education known as classroom update. Assistance has also been provided to the debate teams in the State's high schools. Their topic for the current academic year is United States energy independence.

Other energy projects that are now in the planning and development stages are projects with the Children's Museum in Omaha, a series of non-credit night classes offered through the Technical Community Colleges for the home owner and building contractor to facilitate the energy conservation goals of the Nebraska Conservation Plan. The four states in the region are in the process of initiating an information energy education exchange between Nebraska, Iowa, Kansas, Missouri, the U.S. Office of Education, Region VII of the Department of Energy, and the U.S. Environmental Protection Agency.

Residential Energy Conservation

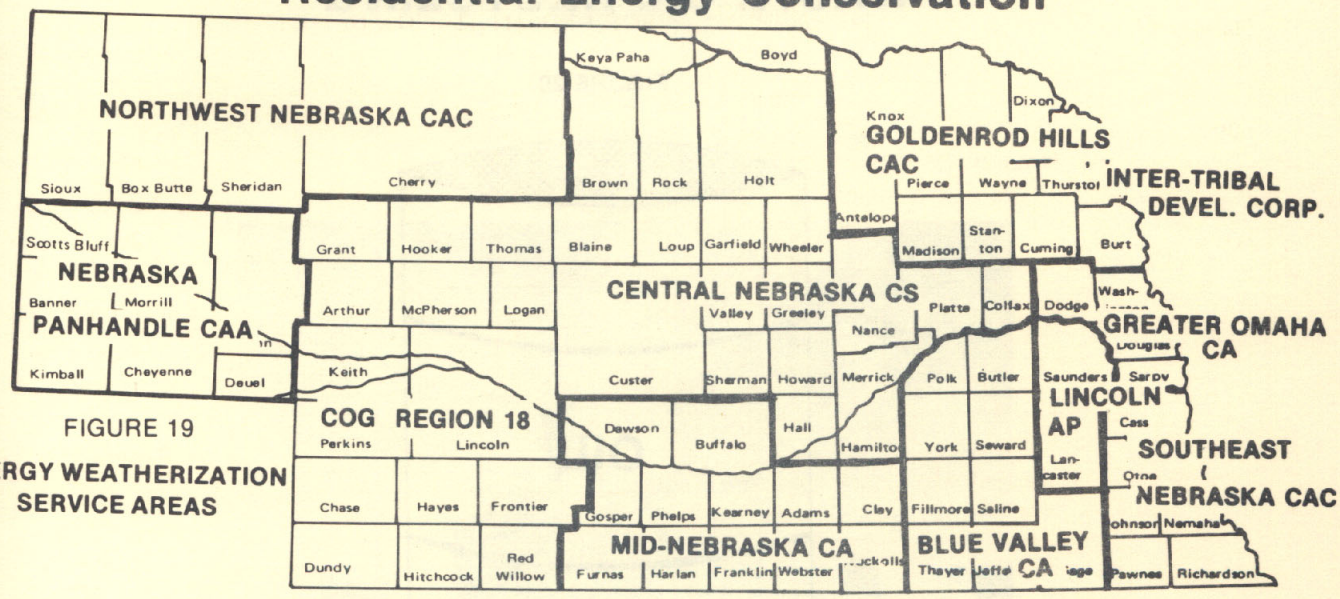


FIGURE 19

ENERGY WEATHERIZATION SERVICE AREAS

Residential energy conservation programs can be divided into two categories, both coordinated by the Home Energy Coordinator and the Residential Energy Specialist, (the latter position added in November, 1978).

The Weatherization Assistance Program for Low Income Persons is a very specific federally funded project while other residential programs are more broad-based.

Figure 19 indicates the various energy weatherization service areas in the State. The purpose of the Energy Weatherization Program for Low Income Persons is to save our nation's energy resources. At the same time this is helping people who can least afford the increasing cost of fuel. Those eligible for weatherization assistance include all low income persons with priority given to the elderly, handicapped, and Native Americans.

A weatherization program in Nebraska has been in operation for over three years through Community Services Administration. Funds continue to be channeled to local Community Action Agencies or their designated service agency from CSA to certify eligible persons in their area. The local agencies also hire workers and supervisors to do the actual weatherization work. Manpower is provided through the Department of Labor, CETA Division (Comprehensive Employment and Training Act).

Late in 1977, the Energy Weatherization Program was initiated within the Department of Energy with the potential of providing additional weatherization funds for the States. In Nebraska, the program is administered by the Nebraska Energy Office. The NEO also subgrants funds to the nine Community Action Agencies in Nebraska, plus one limited purpose agency and the Nebraska Indian Inter Tribal Development Corporation.

By mid-1979, the Department of Energy's program will see approximately 2,652 homes weatherized in the State. If the total dollars from Community Services Administration, plus local resources were considered, the number would be much larger.

Many more Nebraska residents are given the opportunity to learn home energy management techniques through a number of programs operating in the State through the assistance of the Nebraska Energy Office.

The Home Energy Coordinator and the Residential Energy Specialist work with the Cooperative Extension Service, utility company representatives, Nebraska Federation of Women's Clubs, League of Women Voters and other interested groups in utilizing their delivery mechanisms outstate.

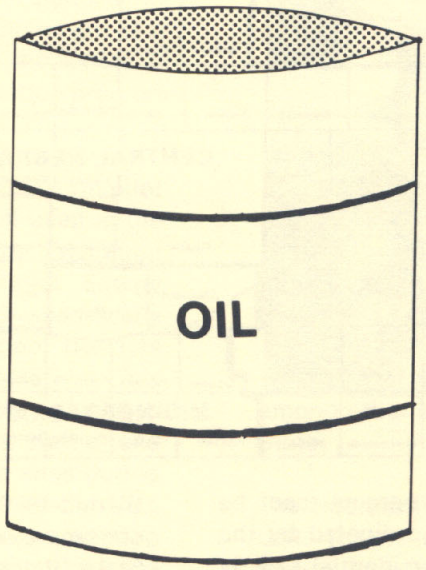
One such project is the Home Energy Check program of the Federated Women's Clubs, who are sharing energy information with families in their communities. Another program is operated through the AGNET computer network system. The NEO provided funds to update a computer-assisted home audit program now available at local county extension offices. It demonstrates actual heating and cooling costs as well as providing recommendations on the cost-effectiveness of energy saving improvements.

The Nebraska Energy Office cooperates with the Nebraska Educational Television Network and the Cooperative Extension Services in the production of a monthly call-in television show discussing energy topics during the winter months.

In 1979, while funding for general home owner services will remain the same, weatherization program funds will almost triple. This represents the most dramatic growth in federal dollars coming to the Nebraska Energy Office for an existing conservation project during calendar 1979.

WASTE OIL RECYCLING

FIGURE 20



It has been mentioned previously that the DOE uses the state energy offices as its implementation vehicle at the state level. For this reason it will be noted later in the flow of authority chart, Figure 24, that authority comes to the NEO from the Department of Energy for sponsored projects. The first of these sponsored projects in point of time is the Waste Oil Recycling Program, a project carried on by private industry, jobbers, and petroleum distributors involving the disposal of oil drained from automotive crankcases.

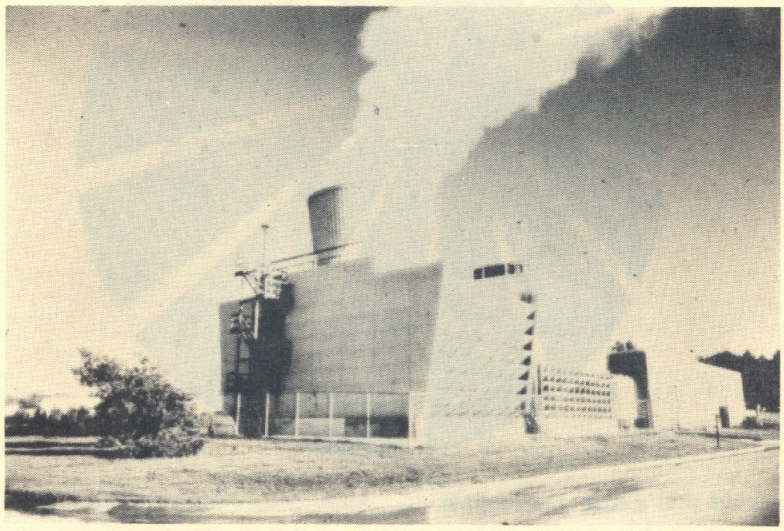
For the past several years private companies seeking to dispose of a large quantity of waste oil have had to pay for its removal, use it in their own boilers or sell it to a private collector. With the creation of the Conservation Plan, consultations between petroleum marketing groups and the NEO began for the phased expansion of the program. UNL has recently completed a study showing present disposal patterns by large public and private entities in the state for 1977.

The NEO expects to make cooperative arrangements early in 1979 with private waste oil collectors for increased collection opportunities in the State to include individuals who change their own oil. Because of the limited number of collection centers at the present time, the program has not been widely advertised for fear of an inundation of used oil beyond the handling capacity of established collection centers.

A recent development in the art of oil recycling has given the NEO an opportunity to make plans for expansion and increased advertising of the program. Scientists under contract to the DOE have recently developed and tested a new process for reclaiming used automotive lubricating oils. The process involves a new technique for removing solid and liquid impurities. After lengthy testing it has been established that this re-refined oil can meet the most stringent standards for automotive lubricating performance. An added advantage is that this new system produces oil that does not generate polluting hydrocarbons, as was the case with oils processed under the older systems. In view of this scientific development and because the plant where this recycling is now being carried on is located in Oklahoma, Nebraska's efforts can be focused on an expansion of the existing oil collection arrangements already established by private industry.

Solid Waste Management

FIGURE 21



Using EPCA funds the NEO has participated in a solid waste disposal plan involving the State, UNL, Lincoln Electric System and the City of Lincoln. The planning process, now at the initial plant design stage, envisages a solid waste mass-turning combustion apparatus that separates large items from the mass of waste without grinding. Non-combustibles are collected as residue, from which metals may be separated for recycling. This project attacks a two-fold problem that has been similarly addressed in Western Europe since early in the 20th century. The first difficulty involved scarcity of oil reserves, resulting in high costs for petroleum and an efficiency advantage in burning the great mass of solid waste that is a result of urban life. The second difficulty obviated by this type of burning is the need to provide for dumping sites if the waste is unused. By burning the waste, the dumping problem is removed and a source of cheap heat energy is provided.

With oil prices quadrupled in recent years and with environmental difficulties associated with coal burning in the United States, it is natural that the European experience would begin to be appealing in this country. Some technical problems have been overcome in waste burning mechanisms in recent years. Improvements in the tempering of metals have lessened the susceptibility of these metals to abrasion. The metal parts of blades and tubes have improved in this same direction.

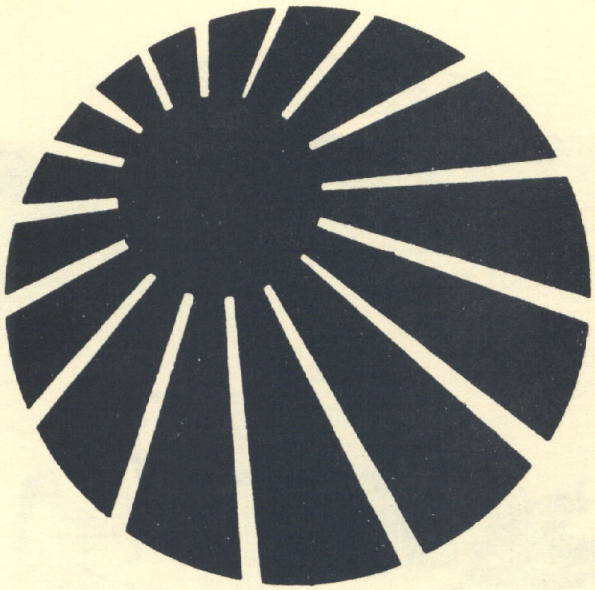
Engineers at the University of Nebraska have developed a proposal for a new central heating and cooling plant in Lincoln that would solve the problem of waste removal and provide a cheap energy source.

An engineering study funded by a grant from the NEO has proposed a central steam and electricity company generating plant in Lincoln using solid waste as fuel. Located near both the University of Nebraska and the Capitol, this plant would provide heating and cooling for the Governor's Mansion, the State Capitol, the State Office Building, and the buildings of the University of Nebraska campuses. The history of this project is interesting in that the Nebraska engineers developed their plans by making their own calculations and projections after examining the results of other bulk waste steam generating plants in both the United States and Europe. Thus, the project is feasible from both theoretical and practical points of view.

The huge benefits in energy saving and waste disposal would seem to indicate that this proposal could move into the actual construction stage as soon as financial planning and first plant design can be completed. A combination of monies from the federal government and the State of Nebraska is envisaged, and, should these arrangements be completed in 1979, construction could begin as early as 1980.

Solar Energy

FIGURE 22



Nebraska has significant experience in utilizing solar energy, the renewable energy alternative most often mentioned as the energy of the future. Mabel Lee Hall, the women's physical education building on the University of Nebraska's Lincoln central campus and the City of Lincoln Housing Authority Building both use solar energy to heat space and water. About two hundred homes in the State are equipped with solar units, and more than fifty firms are engaged in the manufacture of solar equipment. Only one building, the Citizens State Bank Building of Seward, obtains its cooling power from the sun. The largest photovoltaic electric generating array in the world provides power to irrigate 80 acres of land at the University of Nebraska Agricultural Experiment Station at Mead.

Since early 1977 the Carter Administration has sought to increase the nation's effort to develop solar energy, and in July, 1978, regional DOE solar funds became available to create the Nebraska State Solar Energy Office. The Director has his offices in the University of Nebraska Energy Research and Development Center. The Solar Office is integrated into the Mid-America Solar Energy Complex (MASEC) through the NEO, whose Director is on the MASEC Board of Directors. MASEC operations were created to encourage solar commercialization. The several state solar offices are engaged in taking the existing technology that is capable of present application and promoting its use. The technology for solar heating of space and domestic water is relatively complete and the equipment for such tasks is immediately available in the retail market. There are retrofit and hybrid problems, however. Retrofit refers to the remodeling of present structures for solar energy use and hybrid costs refer to the necessary expense of maintaining a complete, traditional standby furnace or hot water heater while adding the solar unit.

Several governmental actions have sought to accomplish the reduction of capital expense involved in solar energy expansion. The 1978 Energy Bill provides some increase in the existing federal loan guarantees and tax credits for citizens installing solar units, and a bill, LB 635, introduced in the 1978 Unicameral sought to give a wide range of state income tax relief for energy-related building improvements. It failed to emerge from the Revenue Committee. An amendment to the Nebraska State Constitution to allow the Legislature to grant property tax exemptions for solar equipment was narrowly defeated in the November, 1978, General Election.

The Director of the Nebraska State Energy Office is also engaged in quality control and labor supply matters. If new solar devices were to fail in quality or be poorly installed the entire program to promote conversion to solar energy would be jeopardized by the ensuing bad publicity. The Director is contacting members of the architectural and engineering community in order to develop an informal code of standards for the solar field. It will also be necessary to interest building contractors in the program. Finally, a whole new craft, that of solar device installation, must be added to the existing skills of the construction labor force.

Irrigation Pump Efficiency Project

FIGURE 23

In mid-1978 the NEO, using DOE conservation funds, entered into an agreement with the Lower Loup Natural Resource District to evaluate pumping efficiency for irrigation wells in the District's 15 countries. The actual field work is being carried on by the University of Nebraska's Institute of Agriculture and Natural Resources during this first year of a potential 3 year project. Because of the plentiful supply of ground water prevalent in almost the entire area within Nebraska's borders, the State's irrigation is done to a very considerable extent by pumping water from deep wells. There are 60,000 of these wells in the State, about one-tenth of them within the District's area of operation. Depending on their location, these wells are pumped by diesel, natural gas, propane or electricity, and large quantities of energy are expended in carrying on this huge task.

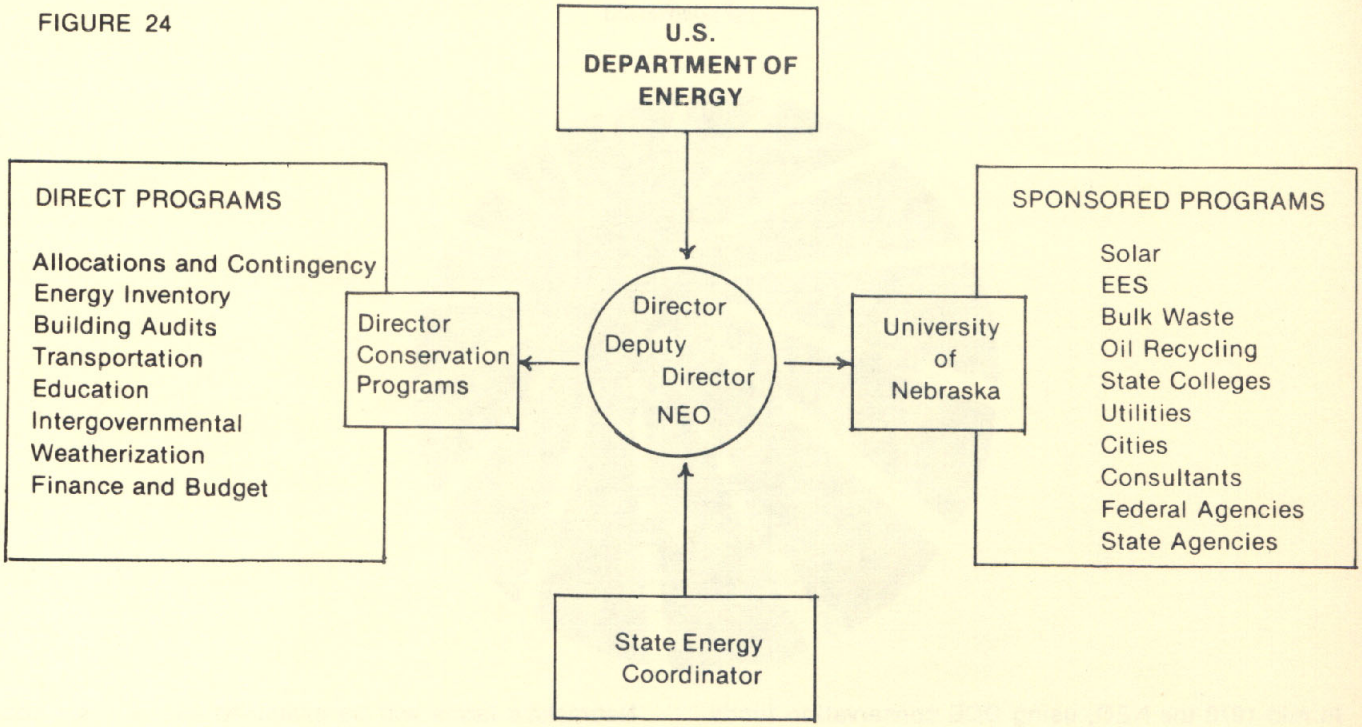
Because of the energy element in this process, the NEO is interested in measuring and, if possible, improving the efficiency of the pumps used in the irrigation process. The Lower Loup Natural Resource District has a long record of cooperating with the farmers of the Loup River Valley and parts of the Platte River Basin in securing proper irrigation of farmland. The Institute of Agriculture and Natural Resources has also had extensive experience in the irrigation field. In cooperation with the University of Nebraska Center for Continuing Education, the Institute has taken part in the famous Irrigation Short Course and the Institute's use of the computer system, AGNET, gives it the potential to monitor and analyze emplacements throughout the State.

A substantial number of pumps used in irrigating Nebraska's farms will be examined over a three year period. This could involve as many as 6,000 pumps and would be an experiment of significant magnitude. The importance of the experiment is evident from the fact that Nebraska farmers invest many millions of dollars in these pumps and because water itself, being one of Nebraska's most important resources, is vital to the future economic development of the State. From an energy point of view, it is significant that the great reliance on fossil fuels characteristic of present irrigation practice in the State calls for a conservation program through increased pump efficiency during the period before these fossil fuels become unavailable and before such fuels are displaced by new energy sources such as solar energy, now being used in the DOE irrigation and crop-drying experiment at Mead, or electricity derived from atomic fusion. The original dollar grant by the NEO for this experiment is sufficient to continue the experiment through its first 12 months of operation.

It is possible that this energy efficiency analysis will follow the pioneering efforts made to measure and improve efficiency in the use of energy on the farm as developed in the Kansas-Nebraska Agricultural Energy Management Program. Under this methodology, a listing of deep irrigation pumps would be obtained from the Nebraska State Department of Water Resources, where a registry of all deep irrigation wells is maintained. The operators would then be contacted and arrangements made for the operators to voluntarily keep records of energy used and amounts of water (times heights) pumped for each individual pump. The AGNET of computer terminals would help in speeding the operation and data gathering for the experiment.

Flow of Authority

FIGURE 24



It was mentioned earlier in this report that the NEO is an entity of the State of Nebraska acting in conservation projects as an implementation representative of the DOE. Constituted under Nebraska Law (LB 232, passed by the 1977 Legislature and signed by the Governor in May, 1977) the NEO operates within a framework of federal laws (PL 94-163, PL 94-385, and the 1978 Energy Act). When one speaks of the flow of authority into and out of the NEO it is necessary to keep in mind that authority comes to the NEO from both the State and the federal government.

L.B. 232 gave the Governor of Nebraska wide flexibility in setting up the NEO, and Governor Exon chose to make the Office a division of the Nebraska Department of Revenue. This accounts for the fact that the Nebraska State Tax Commissioner is the Nebraska State Energy Coordinator. The NEO receives its authority, especially in its constituent aspect, from the Legislature, through the Governor and his Energy Coordinator.

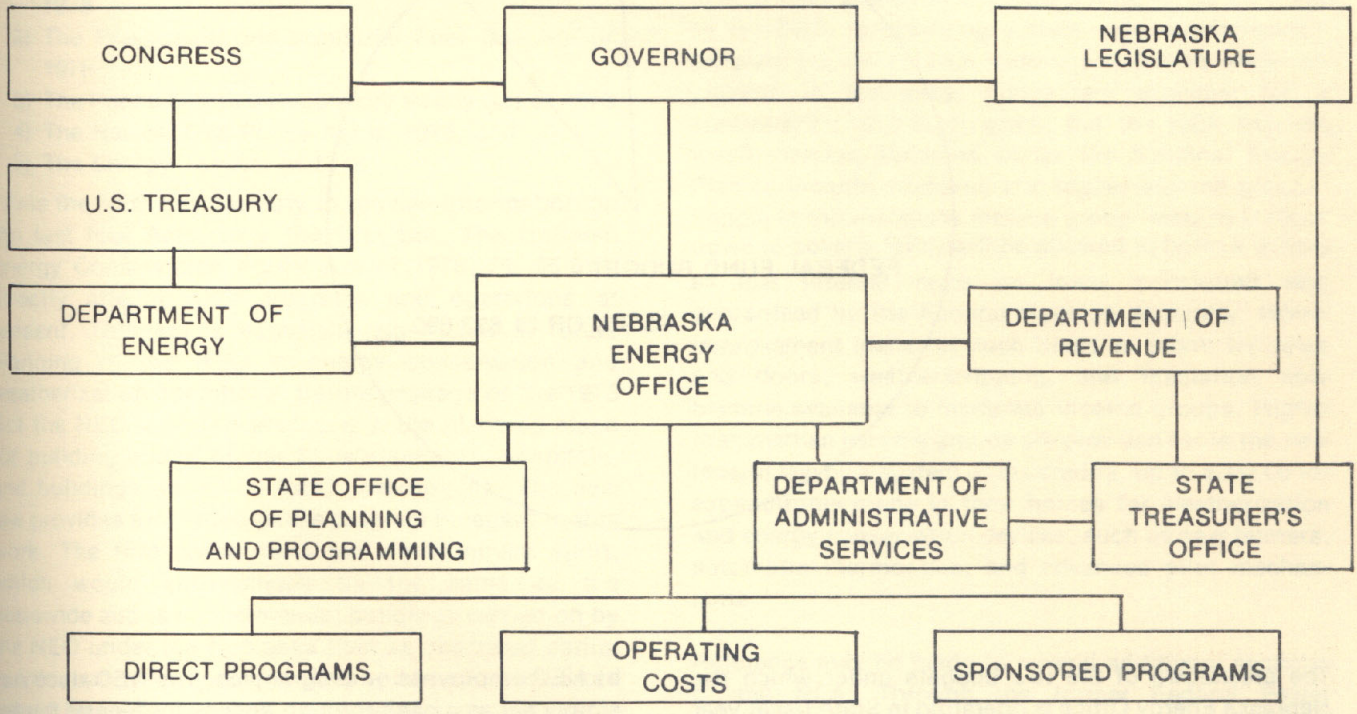
Operationally, the NEO is a portion of Nebraska State government and its employees, payroll, regulations and budget procedures are subject to gubernatorial control and legislative direction. The programmatic thrust of NEO's conservation efforts, however, are approved, monitored and modified under regional DOE supervision. Conservation policies as established by the U.S. Department of Energy must be reflected in the mandatory measures Nebraska promotes in its statewide Conservation Plan. New pieces of federal energy legislation create national programs to be implemented in each state. Shifts in DOE emphasis, such as in the Weatherization program, bring changes to that same project in Nebraska.

The various contracts with institutions of higher learning, private businesses, local governments and school districts are executed by the NEO in its role as DOE representative. This dually derived responsibility of the Director of the NEO is exercised through his Director of Conservation Programs for the direct activity and through the authority given him by the Governor for the sponsored programs. It was pointed out above that the in-office operations such as Allocations & Energy Inventory are under direct supervision of the Director and his Deputy. Thus it may be said that the Flow of Authority Chart presented above represents the broad generality of authority flows, but does admit to exceptions.

The entire National Energy Plan, calling forth, as it does, for efforts from all areas of America's national life, is a broad-gauged effort to deal with the United States energy situation. It is, therefore, not surprising to find in one office, the NEO, a combination of relationships both legal and contractual, enabling the Office to deal with a problem that is at once national and local in nature. The funding of NEO operations is also mixed, a fact that will be brought out in the following section when the flow of authority is reflected in the way monies come into and are spent by the NEO.

Flow of Funds

FIGURE 25



An examination of Figure 25 shows that both State and federal funds are used for operational and program expenses in the NEO. Because each source of dollars has its own rules and regulations a complete separation is maintained and parallel financial records are kept.

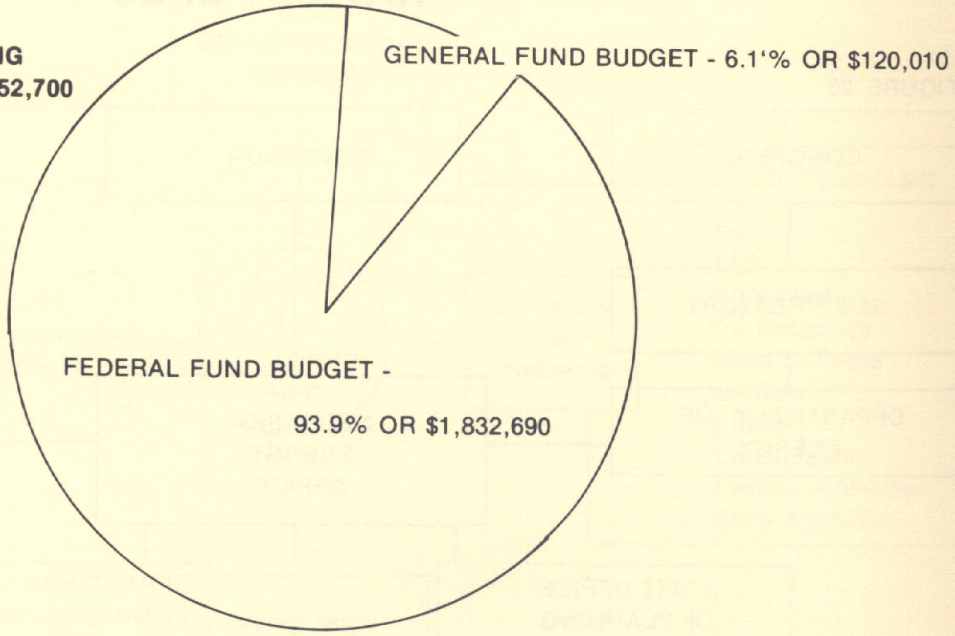
In coordinating NEO financial operations the Budget and Fiscal Officer must begin by considering the intent of both the Congress and the Unicameral in their appropriations acts. Congressional action places funds in the United States Treasury at the disposal of the DOE. The DOE, in turn, sends the necessary money to the NEO to carry on the various energy conservation and other DOE programs in this State. These federal monies are passed through the Nebraska Energy Office and placed on deposit for the Neo in the Nebraska State Treasury.

The NEO takes programmatic direction from the U.S. Department of Energy (DOE) for the grant activities created in the State by the NEO with federal funds. The NEO creates services, establishes working agreements, and negotiates contracts that must be monitored and reported to DOE according to their regulations. Two-thirds of the energy activity performed for DOE outside of the NEO are with sole source agencies. The weatherization subgrantee work performed by the members of the Nebraska Association of Community Action Agencies is the largest example of a sole source service group. The final part of this report where future activities of the NEO are outlined, will show that future operations are very much dependent upon the National Energy Act of 1978, bringing out once again the fact that the operations of the NEO are dependent on national policy as well as upon authority granted it from the Legislature and the Governor of Nebraska.

Budget and Fiscal Operations

FIGURE 26

FY 78-79 BUDGET
BREAKDOWN BY FUNDING
TOTAL FY 78-79 BUDGET $1,952,700



The breakdown of the two budgets under which the Nebraska Energy Office is operating in State fiscal year 1979 reflects both the nature of the NEO operations and the manner in which these operations are carried forward. As seen in Figure 26, the budget consists almost entirely of federal money (94%). The reason for this preponderance of funds from the United States Treasury is that most of the NEO conservation operations were created and funded by federal law. When Governor Exon determined that Nebraska should participate in national energy conservation efforts and specified that the NEO should create and promote a State plan to comply with federal initiatives, he accepted a program with mandatory U.S. Department of Energy requirements as well as Nebraska-specific program possibilities.

A second factor in the heavy orientation for the federal financing of NEO operations is that a significant portion of energy conservation assistance to citizens and groups requires a separate State plan for distribution, monitoring and gathering data on the amount of energy saved as a result of the grant program. Weatherization activity, energy audits of public and private buildings and energy education projects for youngsters and adults are examples. In each case, the program money is federal but the planning, distribution of services, budgetary control and reporting of energy-saving results are performed by NEO employees or subgrantees. The NEO does not simply act as a pass-through agency for federal funds. Rather, the initiative and funding is federal, while the program design, delivery of services, and statistics for both dollars and energy are NEO services and statistics.

Sixty-nine percent of the State portion of the 1979 NEO budget is spent for salaries of personnel. The remaining 31 percent of State funds, which are spent on such things as supplies, travel, rent and equipment, does not reflect the total expenditures by NEO for these objects. A portion of these costs are assessed to the U.S. Department of Energy as administrative and operating expenses where they relate to programs in the Nebraska State Energy Conservation Plan.

One thing is clear in these budget and fiscal structures of the NEO. What President Carter has called the principal task of the National Energy Plan in the near term, that of promoting energy conservation in all sectors of our society, is taking place in Nebraska. Energy offices in other parts of the country have occasionally been criticized for an imbalance in so far as placing emphasis on distant goals involving research and development on an elaborate scale. The NEO, while involved in limited research and demonstration programs, has devoted its attention principally to the task of conserving the energy we now have available.

The New Law

The National Energy Act as passed by Congress on October 15, 1978, after nearly a year and a half of deliberation, is composed of five separate bills:

1) The National Energy Conservation Policy Act of 1978
2) The Powerplant and Industrial Fuel Use Act of 1978
3) The Public Utilities Regulatory Policy Act of 1978
4) The Natural Gas Policy Act of 1978, and
5) The Energy Tax Act of 1978

While the NEO has the duty to provide information on the last four Acts, only the first bill, The National Energy Conservation Policy Act of 1978, PL 95-619, directly affects NEO programs and operations at present. This Act is especially significant in future planning of the NEO in energy conservation and weatherization operations. Before passage of the 1978 Act the NEO was well advanced in the planning stage for building audits of the State's schools, hospitals, and buildings owned by local governments. The new law provides for a three-phase program in regard to this work. The first phase calls for a preliminary audit, which would substantially be the same as the statewide audits of commercial buildings carried on by the NEO under the Nebraska Plan as described earlier in this report. Forty-six hundred buildings in the State would be inspected under NEA provisions and, as in the commercial building audits, there would be an overview of the premises with a view to changing practices or materials in order to achieve energy savings. After this overview certain schools and hospitals will be selected for conservation projects. The second phase involves technical assistance for owners of those buildings. The third phase will be the actual renovating work. Nationally, the Congress has provided nearly a billion dollars for this three-phase operation, which will be on a 50-50 matching basis. Obviously, this involves an expansion of great magnitude for the NEO in the building audits field.

New federal regulations call for the governors of the states to submit plans to the DOE for setting up and operating a system of energy conservation in America's homes, seeking some reduction in the consumption of energy in ninety percent of the nation's residences. The system would: 1) Require utilities to put into operation an information system whereby the customers of such utilities would be made aware of available energy-saving devices and practices; 2) Require utilities to offer to do energy conservation audits of customers' homes should these customers request it; and 3) Require the utilities to offer to install available energy conservation devices in the homes and allow the customers to pay for the installation cost as a part of their regular utility bills. Past NEO experience in building audits, weatherization, and petroleum allocation makes the Office an obvious resource group for both the Governor and the utilities of Nebraska in their joint effort to establish the envisaged system.

It will be recalled that at the present time the Home Energy Coordinator of the NEO, using funds provided by the DOE, is operating a state-wide weatherization program for low income, elderly and Native American citizens in Nebraska. Funds are available for a continuation of this program, but the NEA extends weatherization activities under the National Energy Plan to include moderate and higher income groups. People in the moderate income group (median income down to poverty level) will be allowed to borrow money at low interest rates on loans subsidized and guaranteed by the Federal Housing Authority. Home improvement loans for such items as storm windows and doors, weatherstripping, and insulation now become available to moderate income groups. Higher than median income groups are provided for in the new federal law by a system of tax credits, up to $300.00 for expenditures made in their homes for weatherization and energy conservation devices, such as new burners, automatic thermostats, and advanced pilot mechanisms.

Reference may be made to several additional sections of the NEA. Through the former Federal Power Commission and the present Federal Energy Regulatory Commission the DOE has been active in electricity and natural gas rate regulation for some time. But this has been only in the area of interstate transmission and of federally owned operations. The Public Utility Policy Act of 1978 directs the DOE to become involved in rate making decisions by the state regulatory bodies and, if there is no such body in a given state, with the rate structure of non-regulated utilities, both public and private. In directing the DOE to thus act the Congress had three principal objectives in mind, namely: 1) Conservation of energy supplied by the utilities; 2) The optimization of efficient use by the utilities of their facilities and resources; and 3) Equitable rates to consumers. For the implementation of a plan to achieve these goals for natural gas utilities the Secretary of Energy is directed under the new law to conduct an in-depth study and devise plans to achieve the three goals in that segment of the utilities industry. The NEA is quite complete, however, in listing eleven considerations to be investigated by the utilities in their determination of rates to customers in the electric utilites area. In general, the Congress expresses concern that capital costs in electric utilities not become a factor fueling inflationary pressures and that consumption be moderated without causing severe hardship to some classes of electricity users. The Congress urges the States to present a plan for having the state regulatory bodies, or the non-regulated electric utilities themselves, investigate the eleven

considerations through open hearings with witnesses of permanent record and a formal statement as to acceptance or rejection of such considerations in the rate-determination process. These considerations are complex and technical, and since Nebraska has no State body involved in the regulation of electric utility rates, it would appear that the State's efforts to deal with electricity rates under the NEA will have to use groups in the State, such as the utilities themselves, to evolve a plan of procedure.

The activities of the Allocations and Contingency operations as well as those of the computer-stored Energy Inventory in the NEO are also going to experience expanded activity in the course of the next two years as the result of federal operations. Planning is now substantially advanced in the DOE for establishing an Energy Emergency Monitoring System. In the past at times of embargo, strikes, and natural disasters the information necessary for decision making by both state and national authorities has either been totally lacking or so slow in coming that decision making has been made either impossible or ineffective because of delay. To obviate this difficulty an elaborate system is being set up by the DOE Energy Information Administration to keep all information that would be pertinent in times of energy emergency up to date and available at short notice. This huge store of data and its complex recall and communication apparatus will take three years to establish. The state energy offices are primary users of the new system (entitled EEMIS, Energy Emergency Monitoring Information System) and in the near future some selected states will provide a pilot arrangement for its development. Because the NEO was earlier than most state energy offices in establishing its own energy inventory and in programming its computers to locate supplies of various fuels within the State's boundaries and since it is a prime object of EEMIS to establish such precise locations it would seem that Nebraska might be a likely candidate for selection as one of the EEMIS pilot states. The new national system is not only interested in fuel data, however. In order tc adjudicate the demand-supply situation in any given fuel at a moment in time it is necessary that EEMIS have information about weather and business conditions to determine the state of demand, as well as about transport and other elements of the distribution system on the supply side.

Besides providing for government guaranteed loans and tax credits to support weatherization among homeowners in the moderate and upper income groups, the NEA makes use of these same devices to give impetus to the solar energy program. These loans and tax credits for citizens purchasing and installing residential solar devices attack a most difficult obstacle to the expansion of home use of solar energy. Although the technology is present for heating (and to a considerable extent, cooling) of space and water by sun energy, the fact is that in such states as Nebraska it is necessary to have hybrid systems if complete dependability is to be achieved. In other words, in order to take care of heating or cooling needs when sunshine is not present on a given day provision must be made for traditional furnaces and heaters as well as for the solar installations. Thus, there is the cost of two furnace systems and two hot water heating systems to be accounted for if solar energy is to be used for these purposes in the home. By allowing tax credits and low interest loans to citizens procuring solar devices the government makes possible a reduction in the actual cost of these solar devices. Because of this the reduction in original outlay costs coupled with the drastic reduction in operating costs that use of the sun instead of traditional fuels effects, the Congress has made solar energy costs much more affordable than prior to the enactment of the NEA. Because of this new situation the established work of the Solar Director in Nebraska will expand along with the other NEO operations in the State. Increased sales of new solar installations will require development of quality controls in the production of these devices themselves, as well as an extended effort to bring to the contractors and craftsmen engaged in their installation knowledge of the new techniques required to insure their acceptable performance in the State's residential, commercial, and government buildings.

Most of the programs in the NEO under federal funding are expected to be continuous because of the passage of the NEA. In this regard, it is safe to say that the present NEO education programs are especially attuned to a long term effort. At present the Education Coordinator has programs in progress throughout the school years from kindergarten through high school. These are pilot programs where textbooks, teacher's aids, and general education materials are being developed. Shortly these programs will go beyond the pilot stage and the instructional units now being developed and perfected will become a part of the curriculum of every school in Nebraska. Such expansion is necessary and the program must become permanent if the younger generation is to recognize the nature and extent of the energy problem as a part of America's national life in the years to come.

Because the present programs of the Neo have been founded on a firm basis of practical experience and in view of the fact that the National Energy Act is calling for increased efforts along the very lines which these NEO programs have been proceeding with good results it would seem most logical to conclude that the activities of the Office will expand substantially in these established areas and enter into new fields of endeavor as envisaged by the National Energy Plan.