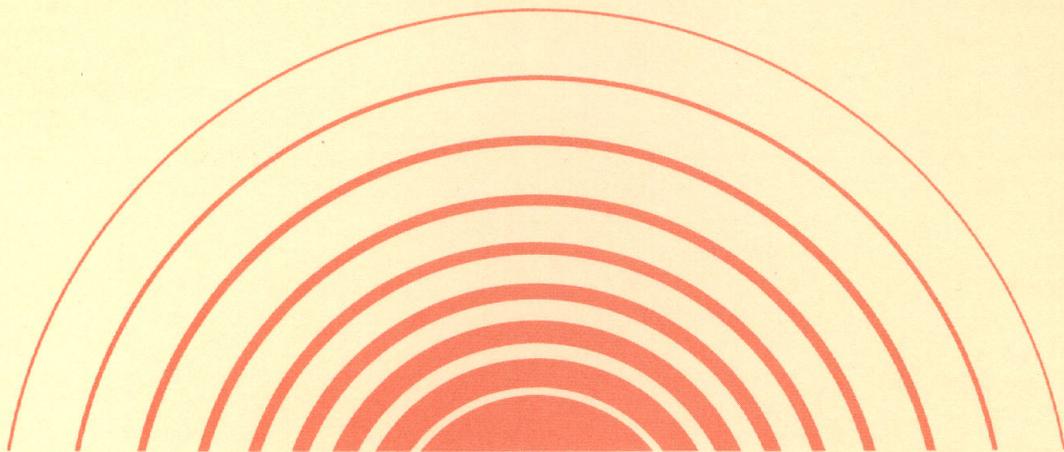




# 1980 annual report



helping to conserve the good life of nebraska

CHARLES THONE  
GOVERNOR



State of Nebraska  
Nebraska Energy Office

Box 95085  
Lincoln, Nebraska 68509  
(402) 471-2867

WILLIAM H. PALMER  
DIRECTOR

December 31, 1980

The Honorable Charles Thone  
Governor of Nebraska  
State House  
Lincoln, Nebraska 68509

Patrick J. O'Donnell  
Clerk of the Legislature  
State Capitol, Room 2018  
Lincoln, Nebraska 68509

Dear Governor Thone and Clerk O'Donnell:

This 1980 annual report is submitted in accordance with provisions of Section 57 of LB 954 signed into law April 23, 1980.

If you have any questions, please contact this office.

Sincerely,

A handwritten signature in cursive script that reads "William H. Palmer".

William H. Palmer  
Director

# table of contents

Introduction .....	2
Conservation .....	3
Weatherization Program .....	5
Residential Conservation Service Program .....	7
Transportation .....	8
Energy Education .....	9
Public Information .....	11
Nebraska Energy Extension Service .....	13
Institutional Buildings Grants Program .....	16
Energy Emergency Planning .....	19
L.B. 954 .....	20
Petroleum Product Set-Aside .....	21
Nebraska Alternate Energy Sources .....	22
Nebraska Solar Office .....	23
Energy Supply .....	24
Nebraska Energy Supply .....	27
Nebraska Energy Consumption .....	34
Energy for Irrigation Study .....	35
Budget Operations .....	39
Nebraska Energy Office Employees .....	40

# introduction

In 1980 Nebraskans voluntarily intensified their efforts to conserve energy by reducing their gasoline consumption by 10.8 percent over 1979 and cutting their residential energy use by the equivalent of 2,166,000 barrels of imported oil.

These successes validate Governor Thone's and the Nebraska Energy Office's position that, barring a disastrous fuel shortfall that requires national rationing, volunteer measures are successful in reducing energy use.

In all 50 states people are talking about the need for energy conservation and energy emergency planning. Nebraska translated talk and concern into action and was the first state in the nation to prepare and submit an energy emergency plan for gasoline to the U.S. Department of Energy.

Three Nebraska Energy Office programs helped Nebraska citizens and institutions pinpoint methods of reducing fuel consumption in 1980. The Ga\$ \$aver Van, a mobile automotive diagnostic center, tested over 2,500 cars at 54 locations from July to December. Savings of \$50-\$200 per year can be expected if a tune-up is done to correct problems identified by the tests.

The Pumping Unit Management Program (PUMP) helped 1,944 farmers in 62 counties learn

methods of increasing the fuel efficiency of their irrigation pumping plants. Average diesel savings achieved as a result of testing and adjustments will be \$466 per year per pump per acre/foot of water.

Approximately 850 buildings received energy audits in 1980 through the Institutional Building Grants Program. Based on a 53 percent compliance rate these buildings will save the equivalent of 186,000 barrels of imported oil per year.

While Nebraskans have been careful to conserve energy the State's electricity generation capacity took a giant leap when two new coal-fired generating plants began operation in late 1979 and early 1980. This reduced the State's petroleum dependency by the equivalent of 164,000 barrels of imported oil per year.

In November, 1980, Governor Thone took executive action and placed responsibility for overall coordination and formulation of Nebraska energy policy with the Nebraska Energy Office. In December executives of the Nebraska Energy Office, Power Review Board, Oil and Gas Commission and the Alcohol Products Industrial Utilization Committee (Gasohol) met to discuss their agencies' activities, data gathering capabilities and energy planning.

# conservation

Voluntary energy conservation programs created with federal funds in 1977 have produced a bountiful harvest of energy savings for Nebraska in 1980. As a result of these programs the Nebraska Energy Office developed a plan projected to save 6.7 percent of the energy required in the State in 1980. This goal has been reached with reported 1980 savings equivalent to 7 million barrels of imported oil. Energy savings reported under the conservation program from 1977 through 1980 total the equivalent of 12.4 million barrels of imported oil.

The most significant advance in energy savings during 1980 was achieved in the transportation sector. In absolute value, gasoline consumption decreased 48 million gallons in 1979 (5 percent less than in 1978) and an estimated 98 million gallons in 1980 (10.8 percent less than 1979). Curtailed vehicle use and increased vehicle efficiency levels are responsible for this dramatic savings.

Reduced travel by state employees, initiated by Governor Thone, saved 400,000 gallons of gasoline in 1980 compared with the base period of 1978.

In addition to these reductions, a total of 318,648 gallons of gasoline were displaced by ethanol as Gasohol sales in Nebraska for the year 1980 reached the 31.9 million gallon level.

### Residential Savings 3.1

Equal in size to the savings in transportation, but amassed slowly over the last several years, is the progress made in the residential sector. One-half of Nebraska's single-family homes now have been weatherized, producing a 1980 energy savings equivalent of 12.6 billion cubic feet of natural gas. Winter and summer thermostat control, improved attic and wall insulation, caulking and weatherstripping, addition of storm doors and windows, as well as closing off unneeded rooms in winter, have all contributed to the energy savings.

Table 1 shows graphically the energy used in Nebraska with and without conservation measures using 1974 as the base year. The upper solid line

would represent estimated energy use growth in Nebraska if no conservation measures were undertaken as forecast by a federal study. The long dash line represents the Department of Energy Base Line, the benchmark from which the State must measure energy savings. The base line reflects the presence of measures implemented by federal agencies such as mandatory car efficiency.

The dotted line represents State energy use if the national goal of a 5 percent energy savings were achieved. The lowest line (dots and dashes) shows

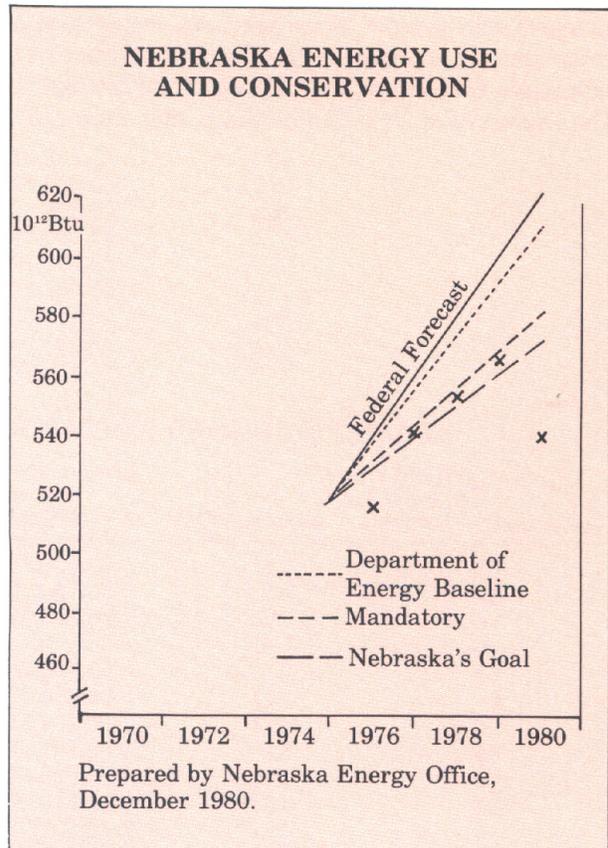


Table 1

the State's actual success in saving 41 trillion Btu in 1980. The crosses indicate estimates of annual energy use prepared by the Nebraska Energy Office.

Increased energy efficiency in new construction during the past year produced savings equivalent to another 1.7 billion cubic feet of natural gas. Residential, commercial and institutional buildings contributed to this increased thermal efficiency.

#### **Agriculture Savings**

Nebraska agriculture produced energy savings equivalent to 28.3 million gallons of diesel fuel. The largest savings were garnered from irrigation efficiency increases with reduced tillage practices, fuel storage improvements, equipment handling and selection techniques contributing the balance of the savings. The University of Nebraska estimates that another 7

million gallons of diesel fuel equivalent was saved by reduced quantities of fertilizer being flushed from fields because of reduced irrigation. This saving is too indirect to be included in Nebraska Energy Office reports.

Industrial energy reductions for 1980 topped the equivalent of 2.3 billion cubic feet of natural gas and 1.3 million gallons of oil. Active conservation projects, the burning of solid and used oil waste products, as well as investments for heat exchange and recovery equipment account for the reported savings.

The use of coal jumped 5 percent in its share of total energy consumption. Coal is being substituted for oil and natural gas in the generation of electricity and has thus reduced the state's petroleum dependency by the equivalent of 776,000 barrels.

# weatherization program

The Nebraska Energy Office administers federal funds to weatherize the homes of low-income persons whose incomes do not exceed 125 percent of the federal poverty level. The weatherization assistance includes caulking and weatherstripping around doors and windows, insulating attics and side walls, cover-

ing windows and other measures which reduce heat loss through infiltration and transmission.

In 1980 a total of 4,692 low-income Nebraskans had their homes weatherized, for an increase of 105 percent over 1979 and savings of an estimated 11,763 equivalent barrels of oil. (See Tables 2 and 3.)

## 1979 NEBRASKA ENERGY WEATHERIZATION PROGRAM GRANTS

Subgrantee	1979 Program Allocations	Total Payments as of 09/30/80	As of 12-31-80 Total Homes	
			Completed	Partially Completed
Blue Valley CAA	\$ 229,175.67	\$ 229,175.67	294	
Central Nebraska CAA	288,171.38	288,171.38	209	
Goldenrod Hills CAA	317,669.24	317,669.24	249	
Greater Omaha CA	476,503.86	471,093.88	405	
Inter-Tribal Dev. Corp. +\$24,139.00 1979 Ins. money reallocated	110,363.51	110,363.51	204	
Lincoln Action	224,637.53	224,637.53	216	
Mid-NE/East	213,292.20	213,292.20	262	
Mid-NE/West	127,067.70	127,067.70	113	
NE Panhandle CAA	161,103.69	161,103.69	222	
Northwest NE CAA	58,995.72	58,995.72	171	
Southeast NE CAA	86,224.50	86,224.50	107	
<b>TOTALS</b>	<b>\$2,293,205.00</b>	<b>\$2,287,795.02</b>	<b>2,452</b>	

Table 2

## 1980 NEBRASKA ENERGY WEATHERIZATION PROGRAM GRANTS

Subgrantee	1980 Program Allocations	Total Payments as of 12/31/80	As of 12/31/80 Total Homes	
			Completed	Partially Completed
Blue Valley CAA	\$ 228,634.00	\$ 228,634.00	121	77
Central Nebraska CAA	362,341.50	330,585.98	296	18
Goldenrod Hills CAA	363,463.00	320,842.83	521	252
Greater Omaha CA	128,206.00	-0-	-0-	-0-
Inter-Tribal Dev. Corp.	57,692.50	57,692.50	5	63
Lincoln Action	373,963.00	375,963.00	418	9
Mid-NE/East	143,163.00	143,163.00	172	-0-
Mid-NE/West	160,791.50	160,791.50	82	40
NE Panhandle CAA	192,308.00	172,898.04	241	69
Northwest NE CAA	164,102.00	146,840.49	140	46
Southeast NE CAA	243,376.50	237,747.01	138	142
<b>TOTALS</b>	<b>\$2,420,041.00</b>	<b>\$2,175,158.35</b>	<b>2,134</b>	<b>716</b>

Table 3

The Nebraska Energy Office has ten contracts with Community Action Agencies and one with the Nebraska Indian Inter-Tribal Development Corporation for delivery of weatherization services. These contracting agencies receive an allocation based on past performance with the program. Additional funds

may be made available to agencies that demonstrate productivity and need.

The delivery of weatherization services varies from agency to agency. Some use professional contractors, however most use Comprehensive Training

and Employment Act (CETA) workers whenever possible. Material costs for weatherization assistance may not exceed \$700 per home and the total cost for both labor and material may not exceed an average of \$1,200 per home.

Quality assurance is provided by the contracting agencies and the Nebraska Energy Office. Each agency inspects its weatherized homes to ensure they meet material and labor standards and the Nebraska Energy Office then inspects some homes on a random basis. In addition, the Nebraska Energy Office makes a minimum of two monitoring visits per agency per year.



Lincoln Action Program Photo  
Lincoln Action Program employee takes measurements for storm windows.

**NEBRASKA HOMES WEATHERIZED  
THROUGH DECEMBER 31, 1980**

Quarter	Total Houses	Funds Expended
<b>1978</b>		
January-March	187	\$ 25,899
April-June	461	184,105
July-September	710	108,520
October-December	180	119,459
1978 TOTALS	1,538	\$ 437,983
<b>1979</b>		
January-March	368	109,704
April-June	289	246,383
July-September	654	332,242
October-December	982	709,453
1979 TOTALS	2,293	\$1,397,782

<b>1980</b>		
January-March	718*	882,979
April-June	1,350	579,785
July-September	1,339	971,777
September-December	1,285	1,392,144
1980 TOTALS	(4,692)	\$3,826,685

\*Includes 106 homes completed with 1978 funds not reported on previous pages.

\*Includes 106 homes completed with 1978 funds not reported on previous pages.

The Nebraska Energy Office has applied for \$3,467,100 for the 1981 program year. This represents an increase of almost 32 percent over the 1980 grant (which in itself was \$216,300 greater than the 1979 grant of \$2,413,900). While this increase is significant, it is possible that Nebraska may receive a greater amount if a national reallocation results because other states are not capable of expending their 1981 funds in a timely manner.



This Lincoln Action Program employee applies caulking to a home to help reduce air infiltration.

# residential conservation service program

The National Energy Conservation Policy Act of 1978 required the largest electric and gas utilities to offer residential energy audits to their customers at modest cost. The following Nebraska utilities were required to participate:

**Kansas-Nebraska Natural Gas Company**  
300 North St. Joseph Ave.  
Hastings, NE 68901  
Contact: Dave Leech, Manager, Energy Utilization

**Metropolitan Utilities District of Omaha**  
1723 Harney Street  
Omaha, NE 68102  
Contact: James B. Knapp, Energy Coordinator

**Peoples Natural Gas**  
29 South Main  
Council Bluffs, Iowa 51501  
Contact: P. B. Lloyd, Area Manager

**Northwestern Public Service Company**  
P.O. Box 220  
Grand Island, NE 68801  
Contact: Ken Hilligas, Division Manager

**Minnesota Gas Company, CENGAS Division**  
1201 "N" Street  
Lincoln, NE 68508  
Contact: Wayne E. Beams, Director of Marketing

**Nebraska Public Power District**  
1414 15th Street  
Columbus, NE 68601  
Contact: Robert Shively, Director of Energy Applications

**Lincoln Electric System**  
P.O. Box 80869  
Lincoln, NE 68501  
Contact: Harold Simmons, Customer Services

## **Omaha Public Power District**

1623 Harney Street  
Omaha, NE 68102

Contact: D. D. Kelly, Assistant General Manager

Governor Charles Thone directed that the Nebraska Energy Office be a voluntary partner with the utilities in writing plans in response to the Act and in carrying out support services. The Nebraska Energy Office funded the basic auditor training of more than 100 utility representatives and is supplying the utilities with copies of the *Nebraska Savings Manual*, free of charge. The 300-page, pocket-size book is given to citizens requesting an audit.

All of the utility plans have been approved by the U.S. Department of Energy and all eight utilities will have audit services available by April, 1981.

During the audit, which will take approximately two hours to perform, the utility auditor will examine: caulking and weatherstripping, insulation, attic ventilation, the thermostat and the efficiency of the furnace. Possibilities for solar domestic hot water systems, active and passive solar applications, and wind energy devices will be evaluated. Management information will also be provided on such low-cost or no-cost areas as furnace maintenance, water flow reduction, thermostat settings and window treatments.

Although many of the rural public power districts and municipalities are not required to participate in this federal program, many of these utilities have indicated that they will perform some of the services required under the Residential Conservation Service Program on an independent basis.

It is estimated that the audits could cost the utilities as much as \$260 each. The residents, however, will only be charged \$15.

The 8 Nebraska utilities were among the first 13 in the nation to have their plans approved by the U.S. Department of Energy.

# transportation

Transportation conservation efforts continue to receive "first priority" under the direction of Governor Charles Thone. The transportation programs conducted by the Nebraska Energy Office are directed at reminding Nebraska motorists of the state's continued dependence on imported petroleum.

The Driver Energy Conservation Awareness Training Program was developed in 1980 to train energy efficient drivers. This workshop program helps individual drivers improve their mileage through discussion of driving techniques and behind-the-wheel experience in a vehicle equipped with gauges which register the driver's mileage rate and indicate every one-thousandth of a gallon of fuel consumed. Vehicle selection, trip planning and maintenance are also stressed. During 1980, training was provided for the State Patrol, state employees, driver education instructors, utility and private fleet operators.

Other transportation conservation activities in 1980 included:

- Development of the "Slow Down" public service campaign and the "Import 2 Less" pledge program. These two programs are reviewed in the "Public Information" section of this report.
- The Lincoln and Omaha carpool and public transit programs received technical assistance, financial help and referrals from the Nebraska Energy Office.
- A pilot project to teach school children the advantages of using public transit was developed by the Lincoln Transit System and Lincoln Public School System with funding from the Nebraska Energy Office. When the pilot project is completed it will be made available to the Omaha Public School System.
- A portfolio of transportation services for commercial and industrial clients was developed to help employers, (1) consider options for business travel and, (2) encourage their employees to adopt energy efficient travel habits.
- The Agricultural Products Industrial Utilization Committee (Gasohol) was awarded a grant to provide educational services for the general public at



World-Herald Photo  
Transportation Coordinator Bob Leavitt at wheel of the car equipped with fuel consumption gauges used in Driver Energy Conservation Awareness Training workshops.

ethanol production pilot facilities. The grant also funded development and distribution of a brochure identifying Gasohol stations in the State.

- The MPG Kit was provided to Nebraska motorists to help them keep accurate mileage and maintenance records.
- An employee transportation study was conducted for Fremont employers to encourage ridesharing activities.
- Nebraska Energy Office staff helped coordinate state and local transportation programs through representation on the Omaha Mayor's Energy Task Force Transportation Subcommittee. In addition, staff members have advised and worked with the State Government Public Transportation Coordinating Committee, the Federal Highway Administration and the Nebraska Department of Roads.

# energy education

Developing a new energy ethic and preparing the next generation for an energy conscious future are the goals of the Nebraska Energy Office education program. To do this the Nebraska Energy Office has developed a nationally recognized education program which addresses energy awareness, conservation and efficiency at the elementary, secondary, post-secondary and support levels.

While working to provide a comprehensive statewide program of energy education the office has requested and received support from (1) the University of Nebraska, (2) Nebraska State Department of Education, (3) state and community colleges and (4) public and private elementary and secondary schools.

## Elementary Education

The K-6 elementary curriculum package, *Energy Conservation Activity Packets*, has been distributed to 450 schools for an impact on approximately 22,500 students.

During 1980 federal funding was awarded to the Children's Museum of Omaha to create an energy experiential exhibit for elementary students. Exhibit design will begin in March, 1981.

## Secondary Education

The secondary school science and social studies curriculum package, *Basic Teaching Units on Energy (BTUs)*, has been distributed to 400 schools for an impact on approximately 40,000 students. This material was developed in Nebraska and has been provided to 30 other states and 3 foreign countries.

Both the elementary and secondary energy education programs will undergo a complete evaluation in January, 1981.

A brochure entitled, *Saving Energy — What Can We Do?*, was developed and distributed to all secondary school student councils. This project has become the focal point of the statewide Nebraska Energy Education Day campaign to be held in March, 1981.

A secondary education energy institute was conducted by the University of Nebraska-Lincoln Teachers College with support from the Nebraska Energy Office and the Department of Energy. Among the results of the institute were the development of additional BTUs and audio-visual materials.

The office is supporting a program to develop a step-by-step method of introducing energy-related curriculum materials into the classroom. This program will augment existing data collection efforts in determining the effectiveness of energy education curricula.

## Drivers Education

The *Energy Efficiency Driver's Education Handbook* has been distributed to 200 secondary schools for an impact on approximately 19,000 students. Success of this handbook can be measured by the fact that it has been incorporated into the Nebraska Driver Education Association's state curriculum guide.

In addition to the driver's education handbook the Nebraska Energy Office has sponsored or co-sponsored the following transportation-oriented publications and programs: (1) *School Bus Drivers Energy Efficiency Handbook and Contest*; (2) Driver's Excellence Program; (3) Driver Energy Conservation Awareness Training; (4) Doron Company audio-visual package and (5) Driver Education Simulator.

## Industrial Arts Education

Industrial arts is taught at the secondary, post-secondary and adult education levels. The following programs exemplify outstanding inter-agency and intra-agency cooperation in the development of energy education courses.

A non-credit home weatherization course was offered in all six community college areas, at the University of Nebraska-Lincoln and in many secondary school industrial arts classes. The project was a joint effort by the Nebraska Energy Office, University of Nebraska-Lincoln Division of Continuing Studies and the six community colleges. A comprehensive student handbook, *The Nebraska Energy Saving Manual*, was distributed in 1980 to replace the original pilot materials.

The Nebraska Energy Office and Vocational Education Division of the Nebraska Department of Education co-sponsored a one-day workshop on automotive energy efficiency at Mid-Plains Community College in North Platte. Approximately 100 independent garage owners/mechanics, secondary and post-secondary automotive instructors attended the sessions focusing on the latest auto efficiency techniques. Based on the success of this workshop and one held in Milford in 1979 the office plans to continue offering the workshop at different locations around the state.

## Home Economics Education

The Nebraska Energy Office began development of the *Home Economics Energy Management Guide* in 1980. The guide will help secondary, junior college and adult education home economics teachers incorporate energy awareness and conservation techniques into their existing housing, food, clothing and family life curriculums.

During 1980 the introductory and housing units were field tested in 50 schools. The food, clothing and family life units will be completed in 1981. An advisory committee of home economics educators has provided input and assistance in developing the objectives and format of the guide and coordinating the field studies.

#### **Post Secondary Education**

The Nebraska Energy Office and the Vocational Education Division of the Nebraska Department of Education have developed two vocational/technical curriculum guides; *Energy Efficiency for Automotive Instructors* and *Energy Efficiency for Heating, Ventilating and Air Conditioning Instructors*.

The guides were written at curriculum development workshops and now are being used in two community colleges to test their effectiveness. After the evaluation period, they will be revised and distributed statewide. Subsequent workshops and curriculum guides are being planned for building construction, architectural drafting and electrical trades instructors.

#### **Education Support Services**

- *The Energy Resources Directory* provides teachers and citizens with local sources of energy information such as print and audio-visual materials, speakers, tours and exhibits. Approximately 6,000 institutions have been supplied with a copy of the directory.
- The 4-H Traditional Energy Study Unit containing study guides for elementary, junior and senior high school members has been distributed statewide. Under the new program, 4-H members will study energy resources, measure household and transportation energy efficiency and construct energy related devices. Many of the new projects can be integrated with existing 4-H programs in engineering, livestock and home economics.
- The 1980 Nebraska Driver's Manual contained two pages dealing with automobile energy conservation. The 1981 manual will have an expanded energy reference.
- The Energy and Environment Simulator is a computer decision-making game which allows participants to make judgements on the use of energy resources,

environmental effects, energy and economic growth, and the quality of life. Two simulators, funded by the Department of Energy and the Nebraska Energy Office, are housed at Wayne State College and loaned out free of charge. Simulator training workshops have been held for strategically located teachers and college professors across the state.

- The Mobile Alternative Energy Center has been planned to provide educators and students with technically sound, useful devices which will demonstrate the basic concepts of alternative energy sources such as hydroelectric, active and passive solar, wind and geothermal. The mobile center will be piloted at Educational Service Unit #3 (ESU #3 serves the Omaha suburban schools) and then made available to all educational service units in the state.
- Inservice Teacher Training was provided during 1980 for all educational projects as part of the Nebraska State Department of Education "Classroom Up-Date" series as well as on an individual request basis.
- Computerized Bus Routing Services are provided to any school district in the state. Use of the routing service can be expected to result in a five to fifteen percent reduction in route mileage and fuel consumption. In addition to energy conservation, the bus routing program can result in lower bus operation and maintenance costs, fewer drivers and buses, and more effective planning and management of school transportation.

This program is co-sponsored by the Nebraska Energy Office, Field Services Division of the Nebraska Department of Education and the Engineering College at the University of Nebraska-Lincoln.

- Energy and the Way We Live, a series of public forums, was conducted in Nebraska's six community college areas during February, March and April, 1980. The Nebraska Energy Office provided technical assistance and speakers for the forums.
- During 1980 the Nebraska Energy Office continued to educate the general public about the need for energy conservation by participating in home shows, energy fairs, energy audit programs, teacher training institutes, utility displays and the 1980 Nebraska State Fair.

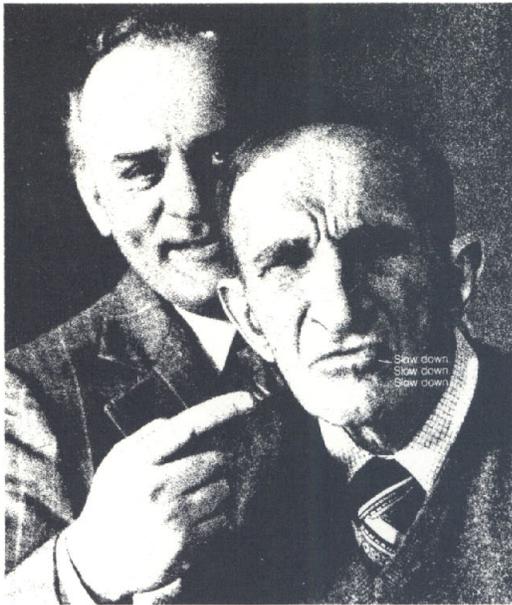
## public information

### Public Service Campaign

On January 3, 1980, Governor Charles Thone held a special news conference to introduce a public service advertising campaign encouraging Nebraskans in their efforts to conserve energy.

Executives of the Nebraska Broadcasters Association, the Nebraska Press Association and the Nebraska Outdoor Advertising Association were present. The Governor thanked these leaders for the time and space their industry had donated over the years to make successful hundreds of charitable and civic campaigns in the state. He called upon them to contribute again to further the cause of saving energy.

The response was tremendous. More than 120 outdoor posters were up at once across the state. Both television and radio stations used the public service announcements. Daily and weekly newspapers published the print messages.



## "Read his lips."

"And besides saving fuel on the highways, please watch that thermostat like a hawk.

Add storm windows, more insulation, weather-stripping, caulking — anything — you watch it, and the whole state saves.

Thank you."

This message brought to you by  
THIS PUBLICATION AND THE NEBRASKA ENERGY OFFICE

Taking part in this campaign with the Governor was Leonard Barr, an old-time comic and dancer. He went from an orphanage to a minstrel show and then to vaudeville, Broadway, night clubs, movies and television. Leonard Barr died in December, 1980, but through newspapers, radio and television stations and billboards he's still reminding Nebraskans, "You want to save energy, you got to save gas. And that's not just another pretty slogan from another pretty face."

### March is Energy Conservation Month

In February, 1980, nearly 100 Nebraska business and government leaders met in Lincoln at Governor Charles Thone's request for the first Governor's Conference on Energy Conservation. The participants reported on energy conservation progress in the public and private sectors. When asked what further should be done to publicly promote energy conservation they requested that the "March is Energy Conservation Month" campaign be reactivated.

The following people were named to the steering committee:

Dean Bergman, Nebraska State Department of Education

George Wolverton, League of Nebraska Municipalities

Dick White, Baker Hardware Store

Jerome Erdman, Metro Area Transit

Fred R. Sikyta, Heating, Ventilation and Air Conditioning Association

Lloyd Keller, Omaha Public Power District

Stuart Wheeler, Kansas-Nebraska Natural Gas Company

Kurt Yost, Mid-America Lumberman's Association

"Import 2 Less" was the slogan of the 1980 campaign. Nebraskans were encouraged to pledge to use two fewer gallons of gasoline per week, thus reducing Nebraska's heavy dependence on imported petroleum. It was estimated that each family making the "Import 2 Less" pledge would save \$123.66 in a year, with gasoline at \$1.19 per gallon in March, 1980.

The slogan originated with the Recreation Vehicle Dealers Association of North America which gave permission for its use in Nebraska.

In addition to encouraging Nebraskans to "Import 2 Less" the March promotion focused on eight petroleum conservation methods: (1) proper tire inflation, (2) engine tune-ups, (3) obeying the speed limit, (4) using energy efficient driving techniques, (5) combining errands, (6) walking or bicycling for short trips, (7) car-pooling to work, school and shopping and (8) using mass transit where available.

The same steering committee members are also advising the Nebraska Energy Office on the 1981 "March is Energy Conservation Month" campaign. Dual emphasis on transportation and residential energy conservation is planned for 1981.

Components of the 1981 campaign are:

- a hardware and lumberyard retail promotion emphasizing home weatherization
- public service announcements for radio and television
- kick-off of the Residential Conservation Award Program
- participation at four home shows and three conventions
- training 80 utility auditors
- E-Flag presentations
- Driver Energy Conservation Awareness Training (DECAT) sessions for many groups across the state.

#### **Energy Conservation Conferences**

By statute the Nebraska Energy Office is required "to actively seek the advice of the citizens of Nebraska regarding energy policies and programs." L. B. 954 further instructed the office to "study the impact and relationship of state energy policies to national and regional energy policies." To meet these obligations the Nebraska Energy Office held a series

of one-day conferences to address the energy concerns of a variety of industry, consumer and fuel sector groups. During the conferences leaders from the affected groups discussed their energy situations, reported their current conservation activities and offered recommendations to the State.

Two conferences for agricultural production and distribution representatives will be conducted in 1981.

The culmination of the 1980 meetings was a Governor's Energy Conference held on November 21, 1980 in Lincoln. Representatives from the separate conferences presented their findings, problems and recommendations.

The speakers were:

Building Construction Industry: Robert Peterson, Peterson Construction Company

Natural Gas Utilities: Thomas Jetton, Northern Natural Gas Company, and Sam Whiteman, Kansas-Nebraska Natural Gas

Electric Utilities: Max Kiburz, Nebraska Power Association

Petroleum Industry: Vincent Brown, Nebraska Petroleum Council

Commerce and Industry: Les Ward, Goodyear Tire and Rubber Company

Renewable Resources: Allan Ziebarth, Solar Resource Advisory Panel

Consumer Groups: Richard Nation, Blue Valley Community Action, Inc.

Alcohol Fuels: Todd Sneller, Agricultural Products Industrial Utilization Committee

Agriculture: Dr. Howard Ottoson, Institute of Agriculture and Natural Resources

A transcript of the meeting will be available for distribution in early 1981.

# nebraska energy extension service

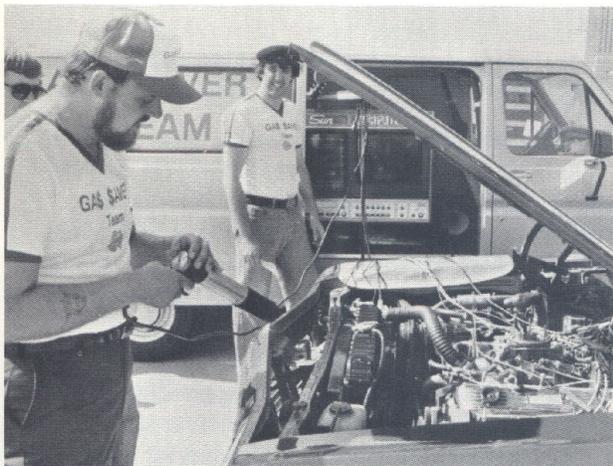
On May 1, 1980, the Nebraska Energy Office received a federal grant to develop and implement the Nebraska Energy Extension Service. Since that time seven service-oriented energy programs and one evaluation program have been established with the goal of providing personalized information and technical assistance services to small-scale energy consumers.

To assist the Nebraska Energy Office in determining the types of services most needed by Nebraska homeowners, farmers, small businesses, automobile owners and local government units, a citizen's advisory board was established by Governor Thone. The board meets to review existing programs and to provide input on new programs.

Nebraska Energy Extension Service programs during 1980 included:

## **Ga\$ Saver Van**

The Ga\$ Saver Van is a mobile automobile diagnostic center equipped with a computer and printout machine. The van, operated by specially trained auto mechanics, travels across the state to offer free auto efficiency testing. Between July, 1980, when the van began operation, and December 1980, over 2,500 cars were tested at 54 locations.



*Gas Saver Team mechanics use an automotive diagnostic computer to check the timing on a vehicle.*

Testing is targeted to private vehicle owners and government fleets. Public testing is available between April and October at shopping centers or other areas with large, easily accessible parking lots. Since the computer will not operate at temperatures below 40°F only indoor locations are scheduled from November through March. During these months the emphasis is shifted from public testing to testing of

government fleets. School districts that have bus fleets and municipal and county government auto pools have participated in the program. The Ga\$ Saver Team has also provided testing to the State Transportation Service Bureau. In addition, the van visits technical community colleges to demonstrate the diagnostic equipment to auto mechanics students.

Car owners who have their automobiles tested can expect to save from \$50-\$200 in gasoline per year if they have a tune-up done to correct problems identified by the tests.

Public response to this program has been tremendous and it is anticipated that during 1981 many more Nebraskans will have their vehicles tested by the Ga\$ Saver Team.

## **Pumping Unit Management Program**

The Pumping Unit Management Program—PUMP—is targeted at Nebraska's irrigating farmers, particularly those who use diesel fuel to power their irrigation pumps.

The purpose of the PUMP program is to increase the fuel efficiency of irrigation pumping plants across the state. To do this a two-van, four-person team of Nebraska Cooperative Extension Service employees conduct field demonstrations of testing methods. During the 1980 irrigation season 1,944 farmers in 62 counties attended field demonstrations. Average diesel savings achieved as a result of testing and adjustments will be \$466 per year per pump per acre/foot of water.

During the winter months the team prepared a training manual, videotape and extension bulletins on the testing techniques. These materials are being used in workshops for well drillers and pump testing consultants so they can assist farmers in making their irrigation pumping plants more efficient.



*A PUMP irrigation specialist demonstrates energy tests to Lancaster County farmers.*

### Conservation Recognition Program

Two separate programs provide recognition for outstanding energy conservation efforts in Nebraska.

The E-Flag Program recognizes business and industry for energy conservation activities in the areas of transportation, building management and alternative energy use. Governor Thone presented E-flags and certificates to five Nebraska businesses in November, 1980.

Nominations for the award are made by knowledgeable citizens across the state. The Nebraska Energy Office contacts each nominee to document information on specific conservation efforts and energy savings.

Additional awards will be made during 1981.

Through the Residential Recognition Program homeowners are rewarded for achieving certain levels of energy efficiency in their homes. The program provides a self-certifying energy efficiency checklist to Nebraska homeowners. If a home meets minimum weatherization and insulation standards the homeowner receives a certificate and a seal which can be affixed to a window or door.

### Easy On Energy

*Easy on Energy* is a live, monthly television program broadcast over the Nebraska Educational Television Network. Each month's program features a panel discussion on a different energy topic and two or three pre-taped "how-to" segments.



Nebraska ETV Network Photo

Dr. Dean Metz, Wayne State College, and Gary Lay, *Easy on Energy* program host, demonstrate the electronic Energy and Environment Simulator.

Viewers are encouraged to call a toll-free number to ask questions of the panel members. An average of 20-30 questions are received during each 30-minute broadcast. The July and August programs on residential summer cooling and new energy technologies for the home generated the largest response from the viewing audience.

### Nebraska Energy News

The *Nebraska Energy News*, published every other month, provides Nebraska energy consumers and educators with up-to-date information on many aspects of energy conservation. Approximately 10,000 individuals and organizations receive the newsletter at no cost.

Articles ranging from "how-to" tips on conservation to updates on technical and financial assistance programs are submitted by many state agencies and University of Nebraska departments.

### Solar Subdivision Program

The Solar Subdivision Program encourages the development of housing subdivisions which incorporate guaranteed solar access and cost effective solar technologies in their design.

The Nebraska Solar Office issued a request for proposals during the fall of 1980 and 75 responses were received. Forty people attended pre-award workshops held in Lincoln and Kearney which featured discussions on solar access and technologies and information on the grant award process.

Four grants of \$5,000 each were awarded to teams of residential developers/builders to develop design, legal and marketing plans for the subdivisions. The funds cannot be used for actual construction. The program is expected to stimulate construction of a number of subdivisions of solar homes in Nebraska in 1981.

### Boiler Efficiency Program

During 1980 the Engineering Extension Service at the University of Nebraska-Lincoln developed a workshop to teach boiler operators how to achieve increased boiler efficiency. Studies have shown that a typical industrial boiler may use 16,000 gallons of oil more than necessary if not properly maintained.

The 1980 Energy Extension Service grant provided funds to conduct 10 workshops. Four workshops were held during 1980 with an average attendance of 45. Six workshops are planned for 1981. Response to the workshops and the *Boiler Operator's Handbook* has been excellent.

### Evaluation Program

Two Energy Extension Service programs have been targeted for special, independent evaluation. The Ga\$ Saver Program and PUMP will be evaluated under a contract with the Bureau of Sociological Research at the University of Nebraska-Lincoln. The programs will be evaluated for response of the target audiences, impact of the testing projects on participants and benefit-to-cost ratios.

The 1980 Nebraska Energy Extension Service Advisory Board was appointed by Governor Thone to provide input on programs for small energy consumers.

#### **1980 Board Members**

William H. Palmer, Director, Nebraska Energy Office  
Irwin Chesen, Director, Nebraska Department of Economic Development  
Dr. Leo Lucas, Dean, University of Nebraska Cooperative Extension Service  
Ralph Knobel, private citizen, Fairbury  
George L. Watters, Director, Nebraska Petroleum Marketers  
H. L. "Pete" Peterson, Administrator, State Task Force for Building Renewal  
Dan Drain, Director, Nebraska Department of Environmental Control  
Dr. Donald Edwards, Director, University of Nebraska Energy Research and Development Center.  
Dr. Quentin Gessner, Dean, University of Nebraska Division of Continuing Studies  
Dr. John Lagerstrom, Director, University of Nebraska Engineering Extension Service  
Caroline Peterson, Energy Chairperson, Nebraska Federation of Women's Clubs  
John L. Sullivan, Executive Vice President, Nebraska New Car Dealers Association  
Lee Orton, Director, Association of Resource Districts

#### **1981 Board Members**

On January 15, 1981 Governor Thone appointed the following people to the 1981 Board.  
William H. Palmer, Director, Nebraska Energy Office  
Irwin Chesen, Director, Nebraska Department of Economic Development  
Dr. Ed Anderson, Director, University of Nebraska Energy Research Development Center  
Quinten Gessner, Dean, University of Nebraska Division of Continuing Studies  
Dr. Leo Lucas, Dean, University of Nebraska Cooperative Extension Service  
Dr. John Lagerstrom, Director, University of Nebraska Engineering Extension Service  
Ralph Knobel, private citizen, Fairbury  
Caroline Peterson, Energy Chairperson, Nebraska Federation of Women's Clubs  
George L. Watters, Director, Nebraska Petroleum Marketers  
H. L. "Pete" Peterson, Administrator, State Task Force for Building Renewal  
Dan Drain, Director, Nebraska Department of Environmental Control  
Ken Haggard, President, Nebraska Well Drillers Association  
Gene Uher, Vice-President, American Charter Savings and Loan  
Lois Milder, private citizen, Omaha  
Hilve Gross, private citizen, Rising City

# institutional buildings grants program

The Institutional Buildings Grants Program was created under the National Energy Conservation Policy Act of 1978. It provides energy audit services and cost-sharing grants for energy conservation to four categories of public and private non-profit buildings; (1) schools; (2) hospitals; (3) local government buildings and (4) public care facilities.

During 1980 the Nebraska Energy Office has conducted energy audits on approximately 850 buildings. Table 4 provides a breakdown of audits by building category. Since the beginning of the energy audit program in 1979 over 1,200 audits have been completed.

## NEBRASKA INSTITUTIONAL BUILDINGS GRANTS PROGRAM ENERGY AUDIT ACTIVITY SUMMARY FOR 1980

Type of Facility	Number of Audits Completed	Percentage of Total
Schools	645	76%
Hospitals	78	9%
Public Care	52	6%
Local Government	75	9%
<b>TOTAL</b>	<b>850</b>	<b>100%</b>

Table 4

Follow-up research indicates that building operators/owners are voluntarily implementing approximately 53 percent of the energy-conserving actions recommended in the audits. Based on this level of compliance, energy audits conducted in 1979-80 will result in an estimated annual energy cost savings of approximately \$5.1 million or the equivalent of 186,000 barrels of imported oil per year. These savings translate into a benefit/cost ratio of 17 to 1 (cost savings to program cost). However, taking into consideration that there are many audit recommendations for which energy auditors are unable to calculate savings, as well as future increases in the price of fuel, these energy cost savings must be viewed as a very conservative figure. Table 5 provides a breakdown of estimated energy savings by type, units and cost of fuel saved.

## Program History

Before offering the energy audit service the Nebraska Energy Office conducted several surveys to gather energy-related building information. In the fall of 1978 survey forms were distributed to all potentially eligible institutions in the state to determine the energy consuming characteristics of their buildings. Participation in the survey was necessary for an institution to receive an energy audit of its buildings and to participate in the grants portion of the program. By June, 1980, the office had received over 2,200 requests for energy audits. Information obtained from the surveys was then used to establish a priority list for audit scheduling. Auditing began in July, 1979.

Nebraska is one of only a few states to provide the audits free of charge. The average cost of an audit is \$150. Rather than require institutions to pay half of the cost, and thereby discourage participation in the program, the Nebraska State Legislature provided funds to match equally the federal money for these inspections.

## Audit Personnel and Procedures

Ten energy auditors were trained extensively in methods of recognizing energy deficiencies in all types of buildings. To provide statewide coverage two-person auditing teams were stationed in Lincoln, Omaha, Grand Island and North Platte.

The energy audit consists of an on-site evaluation of a building for the primary purpose of identifying all low and no-cost opportunities of saving energy in operation and maintenance procedures.

While conducting the walk-through inspection the energy auditor examines the construction of the building, window condition, insulation, infiltration, lighting and mechanical systems.

After inspecting the building an energy audit report is prepared and sent to the administrator of the facility. The report identifies the various areas of energy consumption and then the areas where energy use and costs can be reduced. These energy-saving recommendations are separated into two categories;

## NEBRASKA INSTITUTIONAL BUILDINGS GRANTS PROGRAM ENERGY AUDIT SAVINGS SUMMARY as of December 19, 1980

Type of Fuel Saved	Estimated Units of Fuel Saved	Estimated Energy Dollars Saved
Natural Gas	722,946 MCF/yr	\$2,096,544/yr
Fuel Oil	1,291,282 Gal./yr	\$1,420,410/yr
Electricity	40,413,368 KWH/yr	\$1,616,535/yr

Table 5

(1) operation and maintenance procedures and (2) high initial investments.

Operation and maintenance procedures are low or no-cost ways of saving energy such as weather-stripping, caulking, thermostat and lighting level control, cleaning filters and efficient boiler operation.

High initial investment recommendations include switching from incandescent to fluorescent lighting, adding double-glazed storm windows and insulating walls and ceilings. It is for these types of projects that institutions can apply for cost-sharing grants.

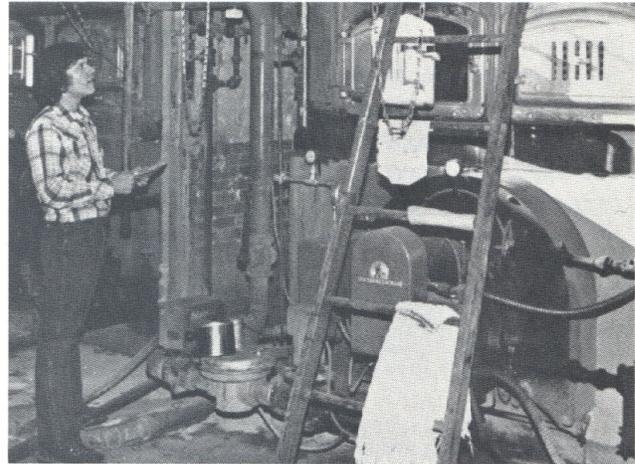
The Nebraska Energy Office will perform free audits on eligible buildings until October 1, 1981. By this date every eligible institution requesting an energy audit will have been inspected. During 1981 the Regional Councils of Government will be working closely with the Nebraska Energy Office to ensure that all units of local government take advantage of the energy audit service.

#### Grants

In 1980 the Nebraska Energy Office successfully completed two grant program cycles. During each of the grant cycles cost-sharing (50/50) grants were awarded to 208 institutions to help finance engineering energy studies and implementation of energy savings projects.

Under the grants portion of the program institutions which have been audited are eligible to apply to receive federal funds to hire an engineer or architect-engineer team to conduct an in-depth study of their building(s). In-depth studies identify cost effective projects which pay back the initial cost of investment through energy cost savings in more than one but less than 15 years.

Schools and hospitals, however, are the only institutions which are eligible to receive federal funds to implement the cost effective energy conservation projects identified by the in-depth engineering studies. These projects might be replacement of old boilers with new energy efficient boilers, reduction of



*Auditor inspects the low-pressure steam boiler at North Platte High School.*

glass areas with brick or insulated paneling or installation of a solar domestic hot water system.

To ensure maximum participation in the grant program by all eligible institutions during 1980 the Nebraska Energy Office initiated a promotional campaign which included (1) development and distribution of program information to 2,966 institutions; (2) presentations for organizations affected by the program and (3) regional workshops for institutional administrators at North Platte, Grand Island, Beatrice, Peru State College, Norfolk and Columbus.

As a result of this promotion 363 eligible applications were submitted for grants during 1980. Based on Nebraska Energy Office recommendations, the U.S. Department of Energy awarded architectural/engineering energy study grants of \$368,723 to 145 schools, 7 hospitals, 3 public care facilities and 3 local government units. Energy conservation construction grants of \$2,019,717 were awarded to 38 schools and 12 hospitals. Table 6 provides a breakdown of funds awarded by building category.

### NEBRASKA INSTITUTIONAL BUILDING GRANTS AWARDED IN 1980

Institution	Type of Grant	Number of Grants Awarded	Total Dollar Amount Awarded
School	Construction Project	38	\$1,186,586
School	Engineering Study	124	320,847
Hospital	Construction Project	12	833,131
Hospital	Engineering Study	7	33,059
Local Government	Engineering Study	3	3,092
Public Care	Engineering Study	3	11,725
<b>TOTALS:</b>		<b>17</b>	<b>\$2,388,440</b>

Table 6

According to a random sampling of 76 engineering studies completed during 1980 an institution can expect to achieve average annual energy cost savings of \$1,760 from the implementation of all low or no-cost recommendations made in the studies. The State can expect an estimated total annual energy cost savings of \$760,764 as a result of the implementation of energy conservation projects funded in 1980.

Because of thorough review of applications at the state level Nebraska institutions have consistently been among the first in federal region VII to receive their grants.

In 1981 the Nebraska Energy Office will administer a third grant cycle. This means additional cost-sharing grants for architectural/engineering studies and energy conserving projects will be

awarded to Nebraska institutions. These future grants will not only add to the energy savings already being achieved but will further contribute to the vital energy security of the State.

#### **Additional Audits**

In addition to audits conducted by the Nebraska Energy Office under the institutional building grants program approximately 130 institutions hired private firms to perform energy audits at their own expense during 1980. Including these audits there now have been over 1,300 energy audits performed on schools, hospitals, local government buildings and public care facilities in the state. If all audit recommendations were implemented, an estimated \$9.7 million in energy costs could be saved annually for a benefit-to-cost ratio of 32 to 1.

# energy emergency planning

During 1980 energy emergency planning was expanded to meet the requirements of federal legislation passed in 1979 and state legislation passed in 1980. As a result, energy emergency planning is divided into two components.

The first component responds to the U.S. Energy Emergency Conservation Act of 1979. It specified that each state is to have an energy emergency plan for gasoline. This plan will be implemented if there is or will be a significant supply interruption of liquid fuels and petroleum products. Nebraska was the first state in the nation to prepare and submit a plan to the U.S. Department of Energy.

As a result of the federal legislation, additional funds will be available in 1981 to support a more detailed analysis of the energy emergency needs of the State.

The second component of energy emergency planning is based on the Nebraska Crises Resource

Management Plan which encourages planning for shortages of all fuel types.

As part of the on-going energy emergency planning process these two components will be merged into one comprehensive plan during 1981.

The first emergency preparedness plan was written for the summer of 1979. Since that time a 1979-80 winter plan, 1980 summer plan and 1980-81 winter plan have been completed.

During the 1980-81 winter season energy data and trends will be followed closely and this information will be incorporated into the 1981 summer update.

Because of the changing energy situation the Nebraska Energy Office will continue to up-date and up-grade the energy emergency plan to ensure Nebraskans of the quickest and best possible response in the event of an energy emergency.

# L.B. 954

Passage of L.B. 954 by the Nebraska State Legislature increased the responsibility of the Nebraska Energy Office in many areas. The following is a summary of these new responsibilities.

## **Thermal and Lighting Standards**

The law provides for establishment of insulation standards for new residential construction begun on or after April 1, 1981 and standards for both insulation and lighting for new commercial and industrial construction begun on or after January 1, 1982.

The act provided for a Nebraska Building Energy Conservation Board. In accordance with the law, Governor Charles Thone appointed the following persons to this board:

Chairman and Ex Officio Member William H. Palmer,  
Director, Nebraska Energy Office  
Architect: Steve Cook, Lincoln  
Engineer: Ray Alvine, Omaha  
Municipal Building Official: J. D. Norman, York  
Home Builder: Robert Peterson, Lincoln  
Construction Trade Person: Bernard Preis, Ralston  
Nonresidential Contractor: George Johansen, Jr.,  
Columbus  
General Public: Cammie Hinds, Lincoln  
General Public: Nancy Snyder, Fairbury

A number of Board members were of the opinion that the Legislature had adopted American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 90-75 as a minimum and given the Board power to adopt higher standards. The Nebraska Attorney General ruled, however, that the Legislature had adopted ASHRAE 90-75 and that the Board's duties were to adopt rules and regulations to administer that standard, approve alternate designs considered comparable to it and handle appeals. The Board adopted such standards

in December 1980 and they were approved by the Attorney General and the Governor.

The Nebraska Energy Office is conducting a campaign to inform local officials of their options under the law and is conducting workshops and preparing training materials to make municipal officials, architects, engineers, home builders and others aware of the law.

## **Emergency Planning**

L.B. 954 specifically gave the Governor power to act under Civil Defense laws in emergencies caused by energy shortages. The Nebraska Energy Office has increased its planning for helping Nebraskans to cope with shortages of energy in any form.

## **Other Regulations**

The law gave the Nebraska Energy Office responsibility for identifying measures eligible for Nebraska Mortgage Finance Fund conservation loans, for identifying measures eligible for the alternate energy sales tax refund and for obtaining reports concerning the energy efficiency of equipment purchased by the State of Nebraska. These duties are being carried out.

## **Data Collection and Reporting**

Two quarterly reports have been made to the Legislature as a result of L.B. 954 and the information in this annual report has been increased in accordance with that legislation. The Nebraska Energy Office has increased its activities in data collection and analysis as best it could without additional funds. In the budget provided to the Legislative Fiscal Analyst on September 15, 1980, in accordance with 81-1113.01, the Nebraska Energy Office reported that it cannot carry out all the data collection and analysis duties assigned by L.B. 954 unless the Legislature appropriates funds for those purposes.

# petroleum product set-aside

The U.S. Department of Energy regulates the distribution and pricing of gasoline and has established a base period for allocation, allocation levels and use priorities which prime suppliers and distributors of petroleum products must follow.

Each month 5 percent of the reported available gasoline is reserved for hardship and emergency situations. The Nebraska Energy Office administers this set-aside program and directs the prime suppliers to make releases when necessary.

The distribution and pricing of middle distillates (fuel oil, kerosene, heating oil and diesel fuel) are not regulated. However, the Nebraska Energy Office, following U.S. Department of Energy guidelines, does provide a 4 percent set-aside of middle distillates for

hardship and emergency situations.

Propane is regulated by the U.S. Department of Energy and the Nebraska Energy Office administers a 3 percent set-aside.

Supplies of petroleum products have varied widely as indicated by the number of requests received for help from the set-aside. Figure 1 shows the changes that have occurred during the past six years. Table 7 compares 1979, when the supply situation was serious, and 1980, when the general supply situation was adequate.

Requests for help with propane were received during January, February, October, November and December, 1979. No requests for propane were received during 1980.

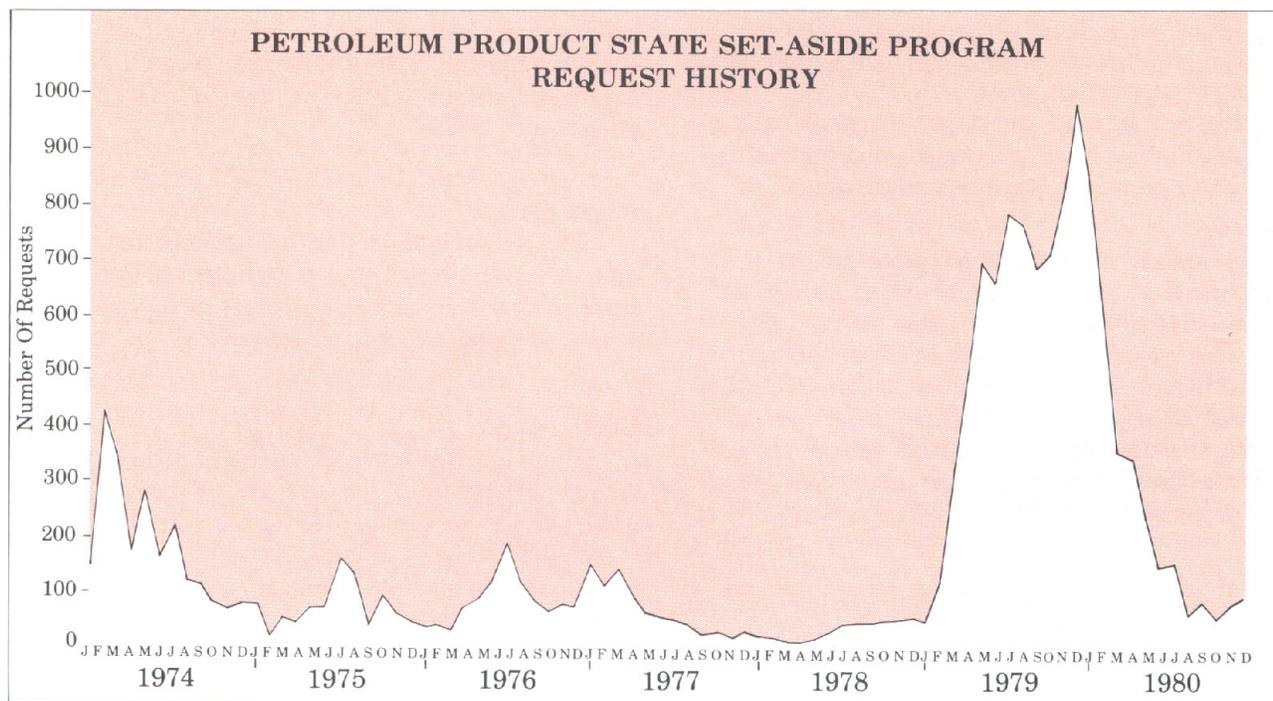


Figure 1

## SET-ASIDE RELEASES DURING 1980 COMPARED WITH 1979

	Number of Requests for Assistance		Percentage of Set-Aside Released			
	1979	1980	Gasoline		Middle Distillates	
	1979	1980	1979	1980	1979	1980
January	40	858	27.0	98.9	0.0	97.6
February	124	623	29.0	96.2	5.6	70.9
March	322	352	82.1	64.8	49.8	21.8
April	522	334	87.9	74.5	85.3	29.1
May	699	235	98.5	52.0	90.1	22.7
June	668	142	96.3	36.4	91.9	28.1
July	796	148	99.0	13.9	94.8	20.8
August	771	64	98.2	10.0	98.6	2.7
September	683	78	99.3	13.5	99.1	4.0
October	753	59	99.0	5.3	100.0	10.0
November	862	76	97.8	11.5	99.9	21.4
December	888	92	96.5	15.8	99.9	25.9

Table 7

# nebraska alternate energy sources

Alternate energy sources such as solar, solid and liquid waste, biomass, waste oil, geothermal and wind are available to Nebraska.

## **Solar**

Solar energy shows good potential in the state. Nebraska is in the top third of the nation in terms of sunlight availability. On an annual basis Nebraska receives 2,000 times more solar energy than the total energy demand. Approximately 1/2,000 of Nebraska's surface area would allow the state to meet all its heating and cooling demands with solar energy. This area would be approximately equal to the area covered by all structure roofs in the state.

Several solar homes monitored by the Nebraska Solar Office reveal that 80 percent of a home's space heating needs can be met with less than a 5 percent increase in construction costs.

Solar energy use is increasing in agriculture. It is being used primarily for grain drying and preheating ventilation systems for livestock confinement.

## **Biomass**

Biomass, which includes the production of ethyl alcohol for Gasohol, has the potential to be a major alternate energy source in Nebraska. During 1980 there were major breakthroughs in Gasohol production techniques. Iowa State University has developed a method of separating alcohol from water without distilling, thereby saving considerable energy. Though still in the research stage, this new process will eventually decrease the cost of alcohol production.

## **Wind**

Nebraska is one of the top five states in the nation using wind energy for agriculture and livestock

production. Wind is efficient as a method of pumping water in remote areas. However, wind generated electricity is not always cost effective at present. Further improvements must be made to reduce the initial cost of wind generators and associated safety equipment.

## **Solid and Liquid Waste**

The use of solid and liquid wastes for electricity or steam generation is feasible for some Nebraska cities. During 1980 the City of Lincoln contracted a feasibility study on a waste-to-energy plant. The report, partially financed by the Nebraska Energy Office, concluded that it is technically, economically and environmentally feasible for Lincoln to build, own and operate a mass burn waste-to-energy plant. If the suggested timetable is followed, the plant could be in operation by 1985.

## **Waste Oil**

The Nebraska Energy Office estimates that waste oil is now being recycled at a rate approaching 10 percent. However, as the price of oil increases the rate of waste oil recycling will increase.

## **Geothermal**

There is a vast potential for use of geothermal energy in Nebraska. A two-year study nearing completion indicates possible uses for geothermal heating in the western two-thirds of the state. When the study is complete, a map showing areas with varying levels of geothermal potential will be printed.

# nebraska solar office

The Nebraska Solar Office was established in 1978 as a joint office of the Nebraska Energy Office and the University of Nebraska Energy Research and Development Center. The office is responsible *for the encouragement, guidance, promotion and coordination of all solar energy programs in Nebraska. The Nebraska Solar Office constantly inventories solar developments in Nebraska, assists industries, individuals, legislators, agencies and groups in the development and implementation of solar energy applications; conducts and coordinates research, development, demonstration, training and service projects; it provides technical assistance to the Nebraska Energy Office; provides close liaison with the Mid-American Solar Energy Complex, the University of Nebraska and appropriate local, state, regional and national organizations.*

It is federally funded, primarily by the U.S. Department of Energy and the Mid-American Solar Energy Complex (MASEC—serving 12 north-central states including Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin).

## Market Development Programs

The market development program seeks to accelerate the acceptance and utilization of solar energy in order to reduce Nebraska's dependence on non-renewable energy imports. To do this the Nebraska Solar Office (1) collects and disseminates information, (2) participates in education and training activities, (3) works on gaining commercialization and consumer confidence for solar technologies and (4) provides intergovernmental liaison.

In 1980 the Nebraska Solar Office, in conjunction with other agencies, sponsored 14 workshops on such subjects as general solar information, passive solar residential design, solar system design for professionals, financial aspects of solar, solar water heating and solar access. At the technical college level the office developed a one-hour videotape presentation on domestic solar water heater components, installation and controls.

Nebraska Solar Office staff made presentations to more than 40 civic, professional, agricultural and

educational organizations in 1980 and distributed literature at the Nebraska State Fair in Lincoln, Tractor Day at Mead and the Energy Expo in Omaha.

The *Solar Yellow Pages* was published to provide Nebraskans with a comprehensive directory of financial information, products, services and consumer tips. For technical assistance the office offers Nebraskans access to its 1,000-volume library, five computer analysis methods and the National Solar Energy Information Data Bank.

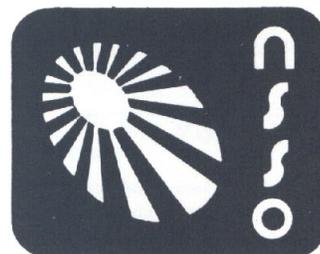
## Areas of Excellence

During the past year the Nebraska Solar Office has concentrated on developing specific areas of expertise within the solar technology field.

The first area, research and development of medium temperature thermal storage units for solar systems, has resulted in production of efficient, low-cost prototypes which will be installed and monitored in 1981.

The office is also developing expertise in the design and development of workshops and instructional materials on passive solar applications for residential construction. MASEC has awarded the Nebraska Solar Office the contract to produce these materials for the 12-state region.

A third area of expertise is solar access. The Nebraska Solar Office provided assistance to the City of Lincoln in writing the ordinance and guidelines for a solar access incentive for developers—the only one in the nation. A “solar rights” ordinance is nearing completion. These activities led to development of the first solar access workshop for land use professionals in the nation in 1980 and presentations at national conferences.



# energy supply

In 1980 energy supplies were sufficient to meet Nebraska demands. This was due to a large surplus inventory of crude oil and its derivatives on the national level, adequate natural gas deliveries to Nebraska and excellent coal inventories and deliveries from out of state. The addition of two large coal-fired, steam turbine electric generation facilities, the Gerald Gentlemen Station near Sutherland and the Nebraska City Station, contributed to a great increase in Nebraska's electricity generation capacity.

## National Supply

The current petroleum status at the national level is shown in the following graphs obtained from U.S. Department of Energy publications. These graphs indicate national levels of petroleum, motor gasoline and distillate fuel oil stocks. All of the refined petroleum products are imported from out of state. Therefore, the national stocks have a direct influence on Nebraska petroleum supply.

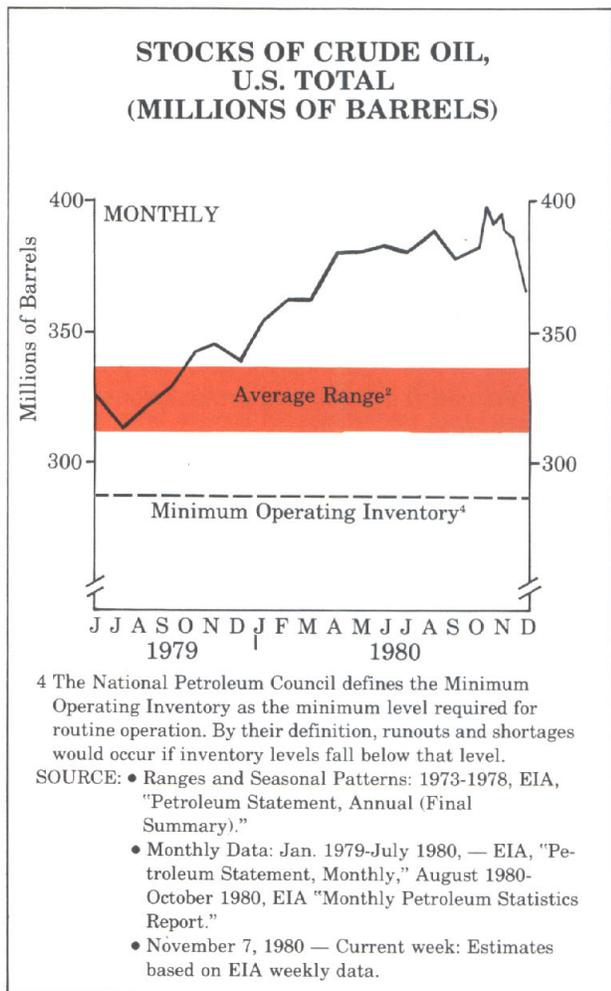


Table 8

As of December 26, 1980 crude oil stocks (Table 8 ) were 15 percent above a year ago. This large stock cushioned the effect of the Iran-Iraq War on world supply and helped moderate prices. If the stock of crude oil decreases into the normal range then the possibility of major price increases from foreign suppliers can be expected.

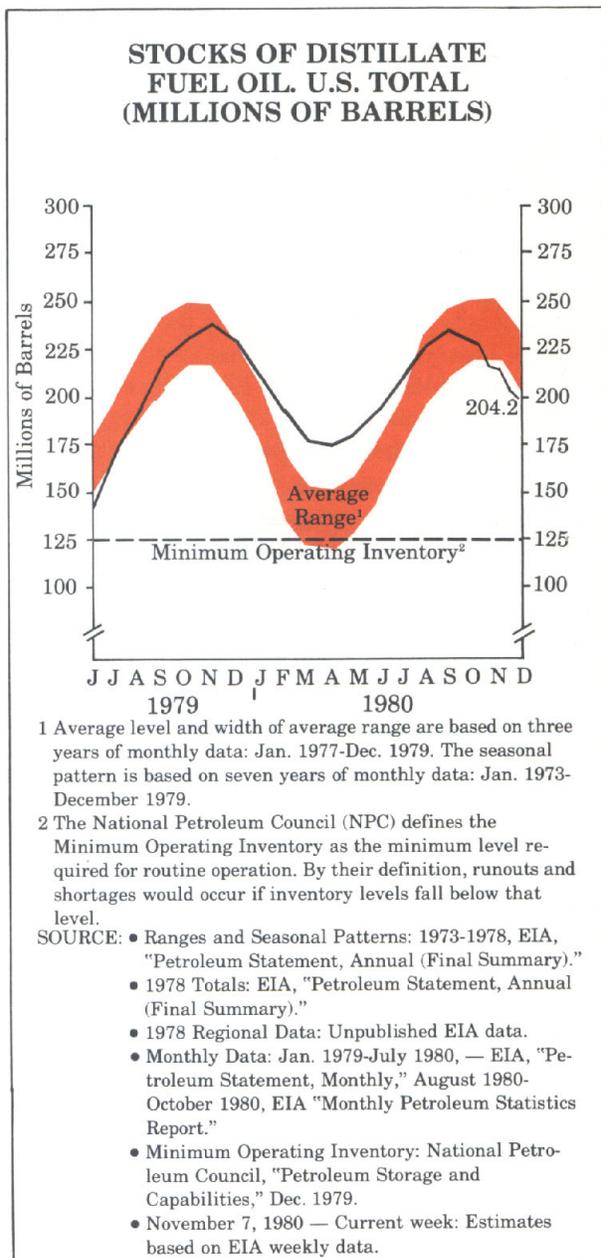
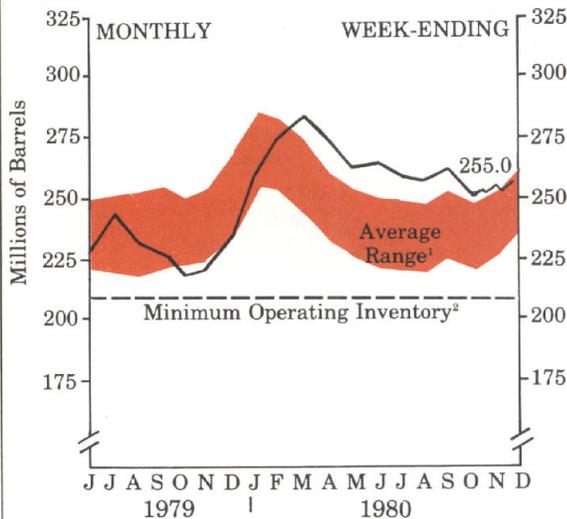


Table 9

Fuel oil and diesel stocks (Table 9 ) have fallen slightly, to 9 percent below a year ago. This slight shortfall will put an upward pressure on fuel oil and diesel prices in 1981.

**STOCKS OF MOTOR GASOLINE,  
U.S. TOTAL  
(MILLIONS OF BARRELS)**



1 Average level and width of average range are based on three years of monthly data: Jan. 1977-Dec. 1979. The seasonal pattern is based on seven years of monthly data: Jan. 1973-December 1979.

2 The National Petroleum Council (NPC) defines the Minimum Operating Inventory as the minimum level required for routine operation. By their definition, runouts and shortages would occur if inventory levels fall below that level.

SOURCE: • Ranges and Seasonal Patterns: 1973-1978, EIA, "Petroleum Statement, Annual (Final Summary)."  
 • 1978 Totals: EIA, "Petroleum Statement, Annual (Final Summary)."  
 • 1978 Regional Data: Unpublished EIA data.  
 • Monthly Data: Jan. 1979-July 1980, — EIA, "Petroleum Statement, Monthly;" August 1980-October 1980, EIA "Monthly Petroleum Statistics Report."  
 • Minimum Operating Inventory: National Petroleum Council, "Petroleum Storage and Capabilities," Dec. 1979.  
 • November 7, 1980 — Current week: Estimates based on EIA weekly data.

Table 10

Motor gasoline stocks (Table 10), which were in large surplus through the summer of 1980, have decreased to the normal range. Motor gasoline stocks are 13 percent higher than a year ago.

The following table provides an overview of U.S. production, consumption and imports of all energy from January through September 1980. Overall production was up 2.3 percent, consumption down 4 percent and imports down a drastic 26 percent. Petroleum production was up 1.3 percent, consumption fell 8.8 percent and imports were down 19.6 percent from 1979. Natural gas fell a slight 1 percent and consumption was down 1.1 percent. Coal production increased 8.7 percent while demand increased only 4.2 percent, allowing an extra 43.3 percent to be exported.

**ENERGY SUMMARY (Quadrillion (10<sup>15</sup>) Btu)  
Cumulative January Through September**

	1980	1979	Percent Change*
<b>Total Production</b>	48.486	47.227	+2.3
<b>Petroleum<sup>1</sup></b>	15.413	15.153	+1.3
<b>Natural Gas</b>	14.690	14.787	-1.0
<b>Coal</b>	14.036	12.863	+8.7
<b>Other<sup>2</sup></b>	4.347	4.424	-2.1
<b>Total Consumption</b>	56.730	58.864	-4.0
<b>Petroleum<sup>3</sup></b>	25.533	27.908	-8.8
<b>Natural Gas</b>	14.967	15.078	-1.1
<b>Coal</b>	11.755	11.239	+4.2
<b>Other<sup>4</sup></b>	4.474	4.638	-3.9
<b>Net Imports</b>	9.320	12.552	-26.0
<b>Petroleum<sup>5</sup></b>	10.203	12.637	-19.6
<b>Natural Gas</b>	0.720	0.903	-20.6
<b>Coal</b>	(1.730)	(1.203)	(+43.3)
<b>Other<sup>6</sup></b>	0.128	0.215	-40.8

Total may not equal sum of components due to independent rounding. Parentheses indicate exports are greater than imports.

\*Based on daily rates in order to remove the influence of leap year.

<sup>1</sup>Includes crude oil, lease condensate, and natural gas plant liquids.

<sup>2</sup>Includes hydroelectric, nuclear, and geothermal power and electricity produced from wood and waste.

<sup>3</sup>Includes refined petroleum products and natural gas plant liquids.

<sup>4</sup>Includes hydroelectric, nuclear, and geothermal power, electricity produced from wood and waste, and net imports of electricity and coal coke.

<sup>5</sup>Includes crude oil, lease condensate, refined petroleum products, unfinished oils, natural gasoline, plant condensate, and imports of crude oil for the Strategic Petroleum Reserve.

<sup>6</sup>Includes net imports of electricity and coal coke.

Source: Monthly Energy Review, December, U.S. Department of Energy.

The world price of internationally traded oil (Table 25) reflects price increases as of December 26, 1980.

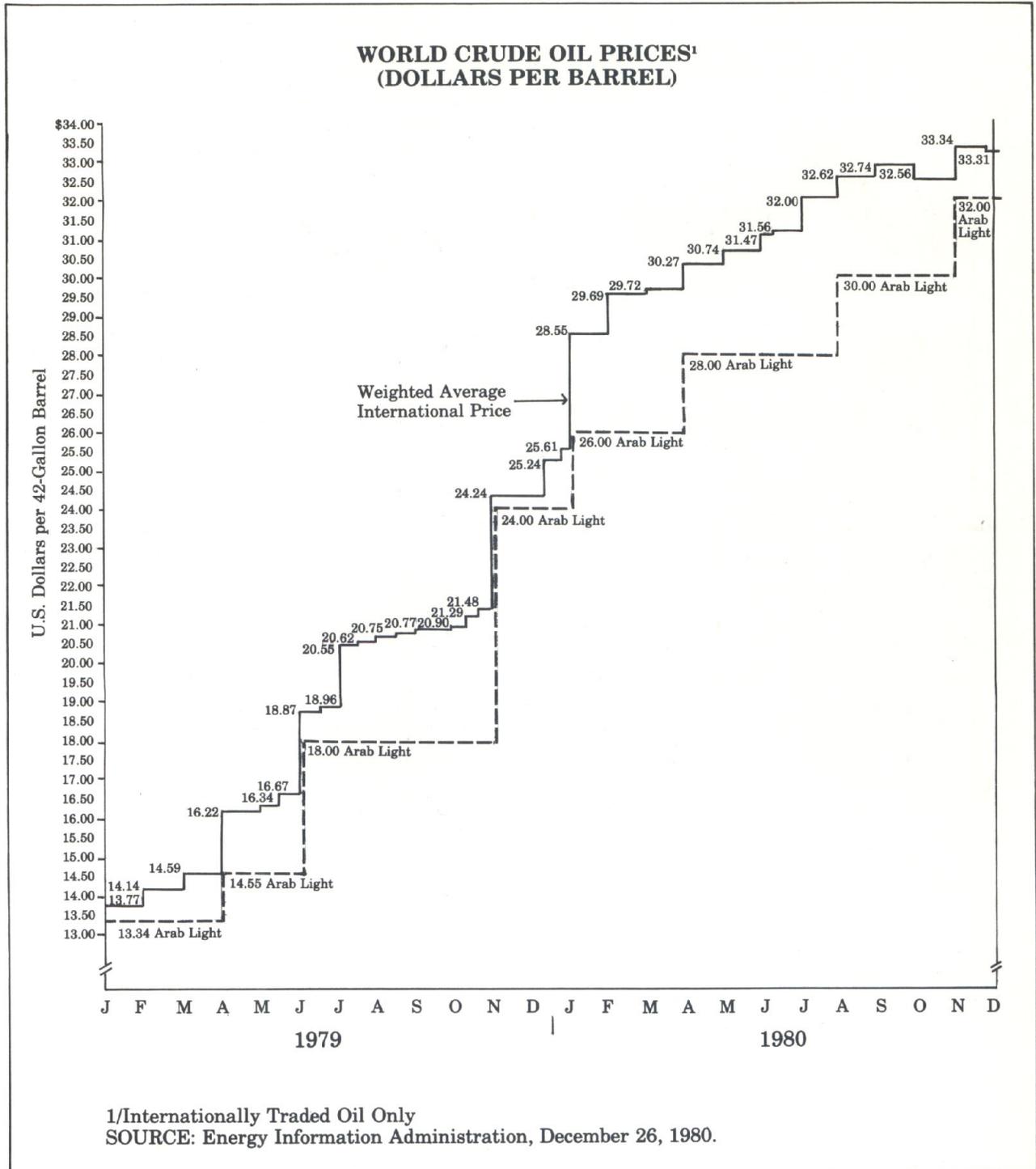


Table 25

# nebraska energy supply

During 1980 Nebraska experienced a slight reduction in the supply of motor gasoline (Table 11). A decrease in gasoline demand is one cause for a relative increase in the supply of gasoline available to Nebraska. This situation has helped stabilize prices. The national average price of gasoline decreased by about one cent per gallon for the nine month period of March to November, 1980 (Table 11a). In 1979 when demand out-paced supply there were lines at service stations and rapidly rising prices.

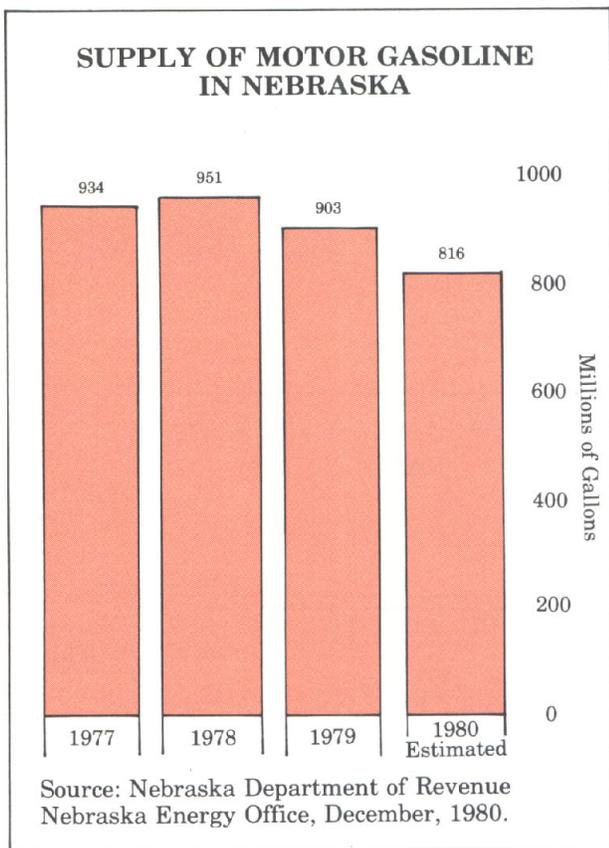


Table 11

The supply of middle distillates in Nebraska (Table 12) was adequate in 1980. Since Nebraska imports all its middle distillates the supply is essentially the same as deliveries. The table shows a consistent decrease in consumption since 1978. The delivery of 483 million gallons in 1980 represents a 9.3 percent decrease from 1979.

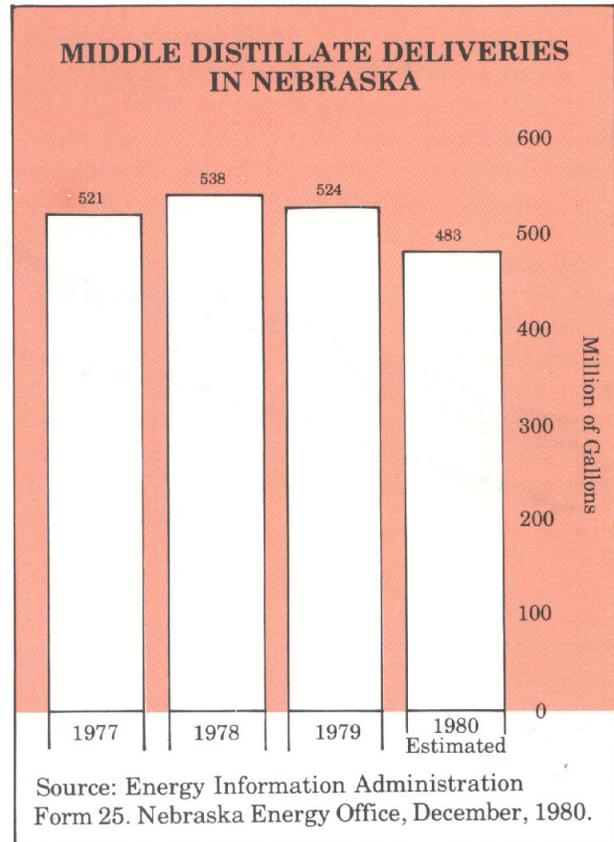


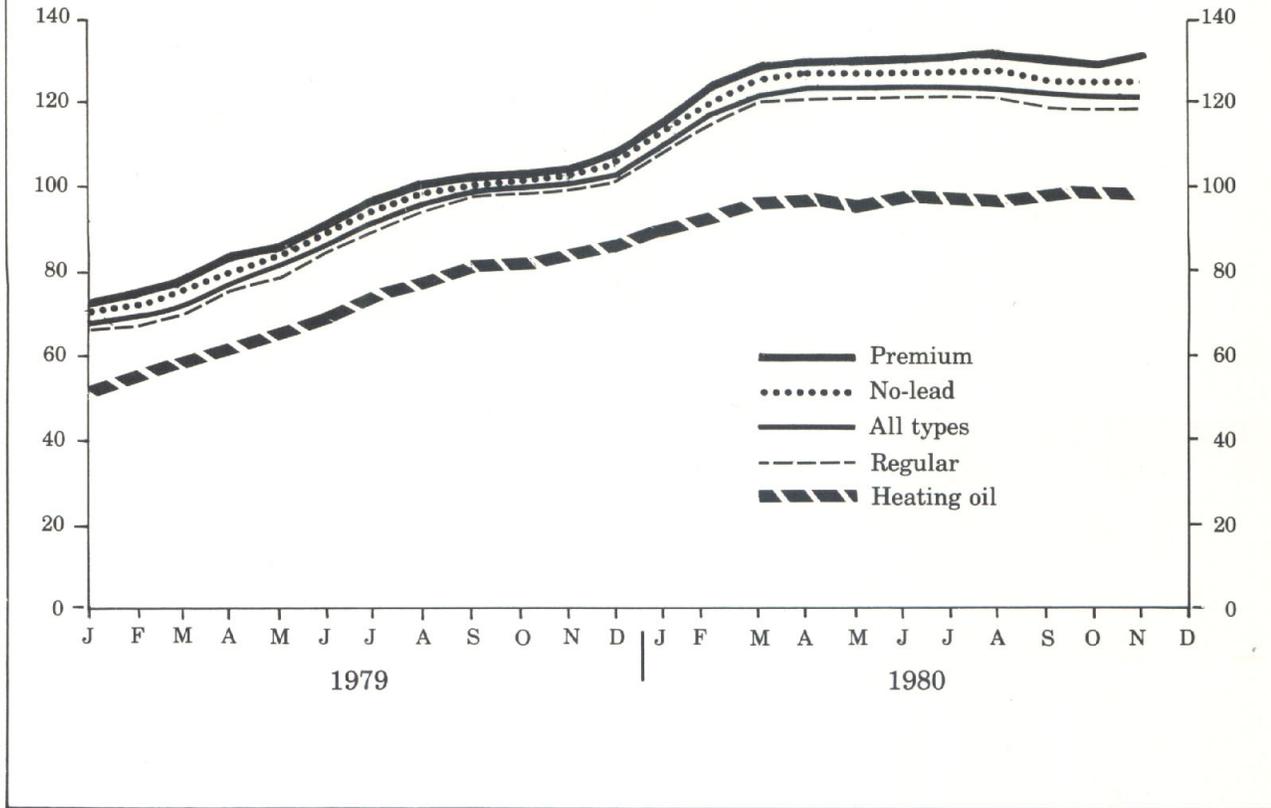
Table 12

## Electricity Production

Electricity production in Nebraska has a strong coal, nuclear and hydroelectric base (Table 13). An ample supply of coal from nearby states makes coal-fired steam turbine generation of electricity a stable source both now and in the future. Table 14 shows an increase in coal consumption for the state's electricity production due to two large coal-fired facilities entering production during 1979 and 1980. A decrease in nuclear production occurred during 1980 (Table 13) because both of the state's nuclear facilities were shut down for three months for maintenance and safety modifications. In 1981 nuclear production is expected to be at the 1979 level.

No new hydroelectric plants have been built in the state since 1941. In 1970 there were only 20 operative hydroelectric plants in Nebraska, excluding the federal installation at Gavins Point Dam on the

**AVERAGE RETAIL SELLING PRICE  
MOTOR GASOLINE AND RESIDENTIAL HEATING OIL  
(CENTS PER GALLON)**



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1978												
Motor Gasoline												
Premium	67.0	66.9	67.0	67.2	67.9	68.8	69.8	70.7	71.4	71.5	72.0	72.9
Regular	60.7	60.5	60.4	60.6	61.1	62.0	62.9	63.8	64.4	64.5	65.0	65.9
No-Lead	64.8	64.7	64.7	64.9	65.5	66.3	67.4	68.2	68.8	69.0	69.5	70.5
All types	63.1	62.9	62.9	63.1	63.7	64.5	65.5	66.3	66.9	67.1	67.6	68.5
Residential Heating Oil	48.5	48.6	48.6	48.6	48.3	48.2	48.2	48.2	49.0	50.2	51.5	52.7
1979												
Motor Gasoline												
Premium	73.7	75.0	77.4	82.4	86.7	92.0	96.5	100.4	103.6	104.6	105.6	108.0
Regular	66.8	68.1	70.6	75.3	79.7	85.6	90.8	94.3	97.3	98.2	99.4	101.8
No-Lead	71.6	73.0	75.5	80.2	84.4	90.1	94.9	98.8	102.0	102.8	104.1	106.5
All types	69.5	70.7	73.3	78.0	82.3	88.0	93.0	96.7	99.8	100.6	101.9	104.2
Residential Heating Oil	53.7	56.3	58.7	61.1	64.2	69.1	73.9	78.4	81.0	82.3	83.7	85.8
1980												
Motor Gasoline												
Premium	114.9	123.3	127.7	129.2	129.5	130.0	130.7	131.0	130.4	129.9	130.1	
Regular	108.6	115.9	120.2	121.2	121.5	121.7	121.6	121.0	119.7	118.8	118.8	
No-Lead	113.1	120.7	125.2	126.4	126.6	126.9	127.1	126.7	125.7	125.0	125.0	
All types	111.0	118.6	123.0	124.2	124.4	124.6	124.7	124.3	123.1	122.3	122.2	
Residential Heating Oil	90.8	85.3	97.1	97.4	97.2	97.9	97.9	97.9	R98.1	98.9		

R = EIA Revisions

NOTE: Motor Gasoline data include prices from self-service stations.

SOURCE: Motor Gasoline — Bureau of Labor Statistics. See definition for description of survey.

Residential Heating Oil — FEA Form P112-M-1/EIA-9, "No. 2 Heating Oil Supply/Price Monitoring Report".

Table 11a

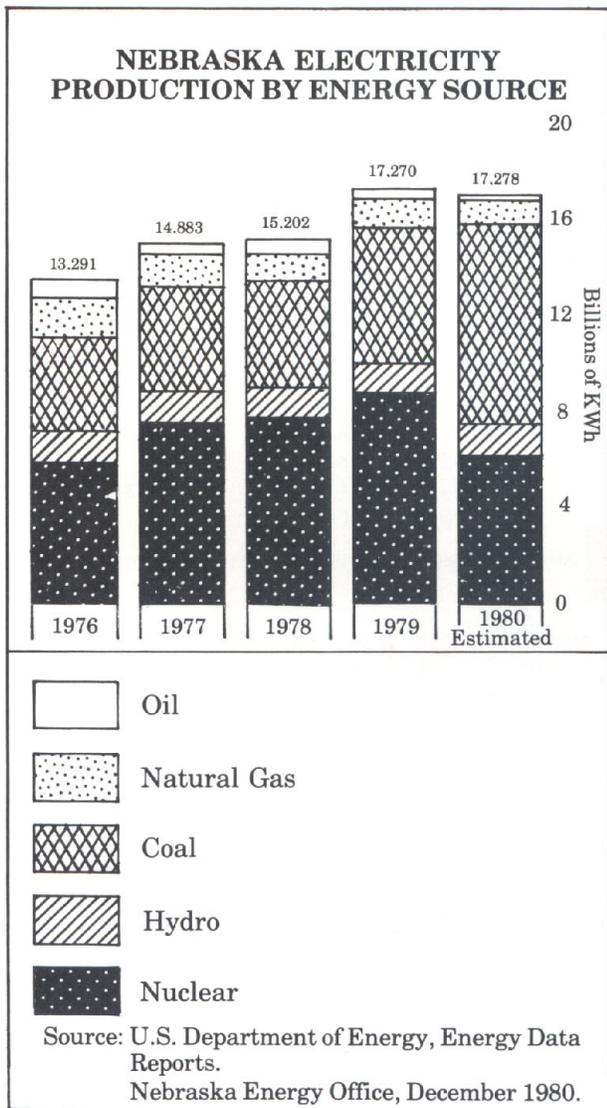
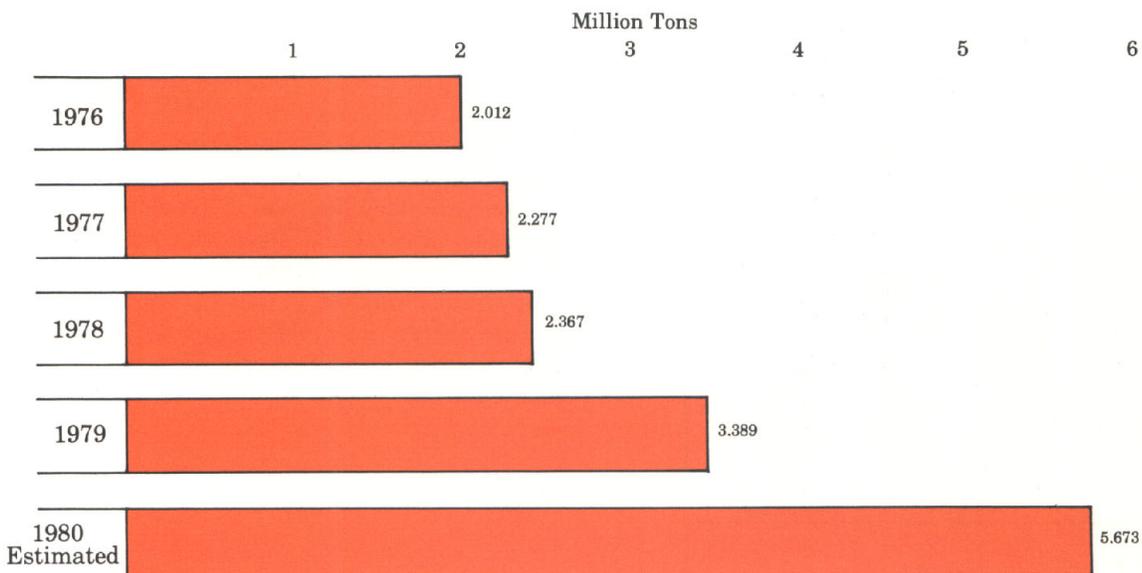


Table 13

Missouri River. A decision has been made to put electric generators on Kingsley Dam in Ogallala. This is especially attractive because irrigation water will produce electricity for summer peak shaving. The Nebraska Energy Office is compiling information for an update to the report, *Small Hydroelectricity Potential in Nebraska: An inventory of existing dam sites in the state.*

Petroleum use for electricity generation in Nebraska has shown a steady decrease (Table 15). Natural gas and petroleum are used to generate peak load electricity. During the unseasonably hot summer of 1980 air conditioning demand was high and many peak load records were set. In spite of this, the electric utilities were able to meet most of the demand with the coal-fired units. This helped conserve the supply of middle distillates.

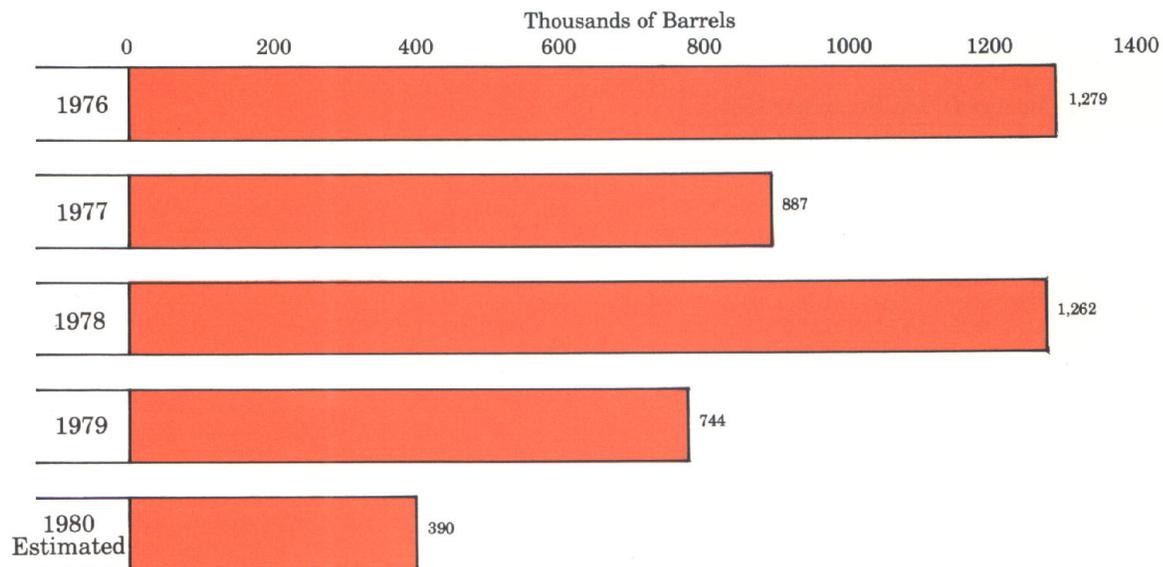
### COAL USED FOR ELECTRICITY GENERATION IN NEBRASKA



Source: Energy Data Reports, U.S. Department of Energy. Nebraska Energy Office, December, 1980.

Table 14

### PETROLEUM USED FOR ELECTRICITY GENERATION IN NEBRASKA



Source: U.S. Department of Energy, Energy Data Reports. Nebraska Energy Office, December 1980.

Table 15

**PRIMARY FUELS USED FOR ELECTRICITY GENERATION BY MAJOR NEBRASKA  
ELECTRIC UTILITIES IN 1980**

(From FPC 12 E2 Reporting Forms)

Month	Net Generation MWH*	Bitum. Coal Sh. Tons	Heavy Oil Barrels	Light Oil Barrels	Natural Gas MCF	Propane Gallons
January	1,426,944	404,910	30,602	5,146	244,773	300
February	1,365,426	469,262	15,648	3,902	292,572	
March	1,042,353	573,557	1,506	4,767	365,423	1,445
April	854,321	469,414		11,836	217,393	
May	761,962	416,726		3,464	256,990	
June	1,084,663	354,570		6,702	298,373	
July	1,843,024	973,912	15,189	3,902	605,043	
August	1,485,299	426,001	1,171	2,136	520,763	
September	1,112,936	208,452	496	2,388	392,707	
October	1,018,548	148,892		945	252,266	400,000
November	1,048,071	233,251	2	3,481	191,190	
<b>TOTAL</b>	<b>13,043,547</b>	<b>4,678,947</b>	<b>64,614</b>	<b>48,039</b>	<b>3,637,493</b>	<b>401,745</b>

\*1,000 Kilowatthours = 1 megawatthour = 1 MWH

Table 16

Electricity generated by the major Nebraska electric utilities (Nebraska Public Power District (NPPD), Omaha Public Power District (OPPD), Lincoln Electric System (LES), Grand Island and Fremont) and by fuel used for electricity generation are presented in Table 16. Electricity generation had a very slow growth in 1980; 0.2 percent compared with

13.6 percent in 1979. The recession and a shutdown of both nuclear power stations are believed to be the reasons for this slow down. Table 16 also shows the definite switch from oil and gas to coal. For 11 months of 1980 the utilities used 4.67 million tons of coal compared with 3.09 million tons in the corresponding months of 1979.

**ELECTRICITY SALES TO ULTIMATE CONSUMERS  
BY NEBRASKA MAJOR ELECTRIC UTILITIES (NPPD, OPPD AND LES) IN 1980**

(From Edison Electric Institute Monthly Reporting Form)

Month	Total Sale MWH*	Residential MWH*	Commercial MWH*	Industry MWH*	Public Use MWH*	Sales For Resale MWH*	Purchased From Others MWH*
January	755,435	284,448	237,180	205,523	29,692	728,378	650,745
February	750,539	283,001	248,469	201,811	30,092	681,900	979,982
March	720,262	271,105	212,022	197,782	28,260	636,403	834,966
April	631,323	222,609	194,881	189,705	26,137	546,014	589,531
May	612,212	187,778	193,083	199,192	27,400	504,535	579,061
June	697,776	229,331	217,942	204,170	27,727	582,468	659,078
July	899,530	379,138	262,541	211,301	29,698	963,103	917,090
August	906,482	398,090	281,268	214,345	34,461	733,610	870,842
September	804,746	326,801	254,744	209,755	32,239	541,159	679,105
October	638,293	204,652	213,517	193,716	30,101	457,459	588,407
November	623,062	205,236	200,952	189,509	28,478	430,721	617,865
<b>TOTAL</b>	<b>8,039,660</b>	<b>2,992,189</b>	<b>2,516,599</b>	<b>2,216,809</b>	<b>324,285</b>	<b>6,805,750</b>	<b>7,966,672</b>

\*1,000 Kilowatthours = 1 Megawatthour = 1 MWH

Table 17

### Electricity Sales

Sales of electricity to ultimate consumers in Nebraska are shown in Table 17. The first five columns show direct sales by three major utilities (NPPD, OPPD and LES). The last two columns present the interchange of electricity between these three utilities and all others, public and private, within the state and with other states.

Electricity sales to Nebraska consumers showed moderate total growth of 3.7 percent. The greater part of this increase took place in the residential sector (5.9 percent) apparently because of the hot summer weather and resulting high air conditioning load.

Commercial and industrial sales had moderate growths of 1.4 percent and 2.8 percent respectively.

The Nebraska natural gas supply depends on production elsewhere. Nebraska produces only 2 percent of the natural gas it consumes. Most of the decline in consumption since 1972 has paralleled the decline in U.S. production. Changes in the price of natural gas are shown in Table 19. The wellhead price for natural gas is expected to increase at least 15 percent per year until 1985. Higher wellhead prices make economical the use of new natural gas production techniques, thus increasing the supply.

### NEBRASKA OIL PRODUCTION

The following table is a comparison of oil exploration, well development and production on a monthly basis. Note that the production is in 42-gallon barrels.

	1979	1980	DRILLING PERMITS			
	Production in Barrels	Production in Barrels	1979 Exploratory	1980	1979 Development	1980
January	483,206	502,703	35	45	22	21
February	451,691	480,512	10	21	18	27
March	515,334	516,836	20	20	22	25
April	501,530	486,000	25	19	27	30
May	525,112	540,000	20	27	14	28
June	507,398	509,397	18	17	20	32
July	518,302	504,840	36	14	17	33
August	543,823	547,833	20	13	20	16
September	508,758	534,617	24	34	16	22
October	536,185	539,889	38	41	18	32
November			37	34	26	30
<b>TOTALS</b>	<b>5,091,339</b>	<b>5,162,627</b>	<b>283</b>	<b>285</b>	<b>220</b>	<b>296</b>

Source: Oil and Gas Conservation Commission

Table 18

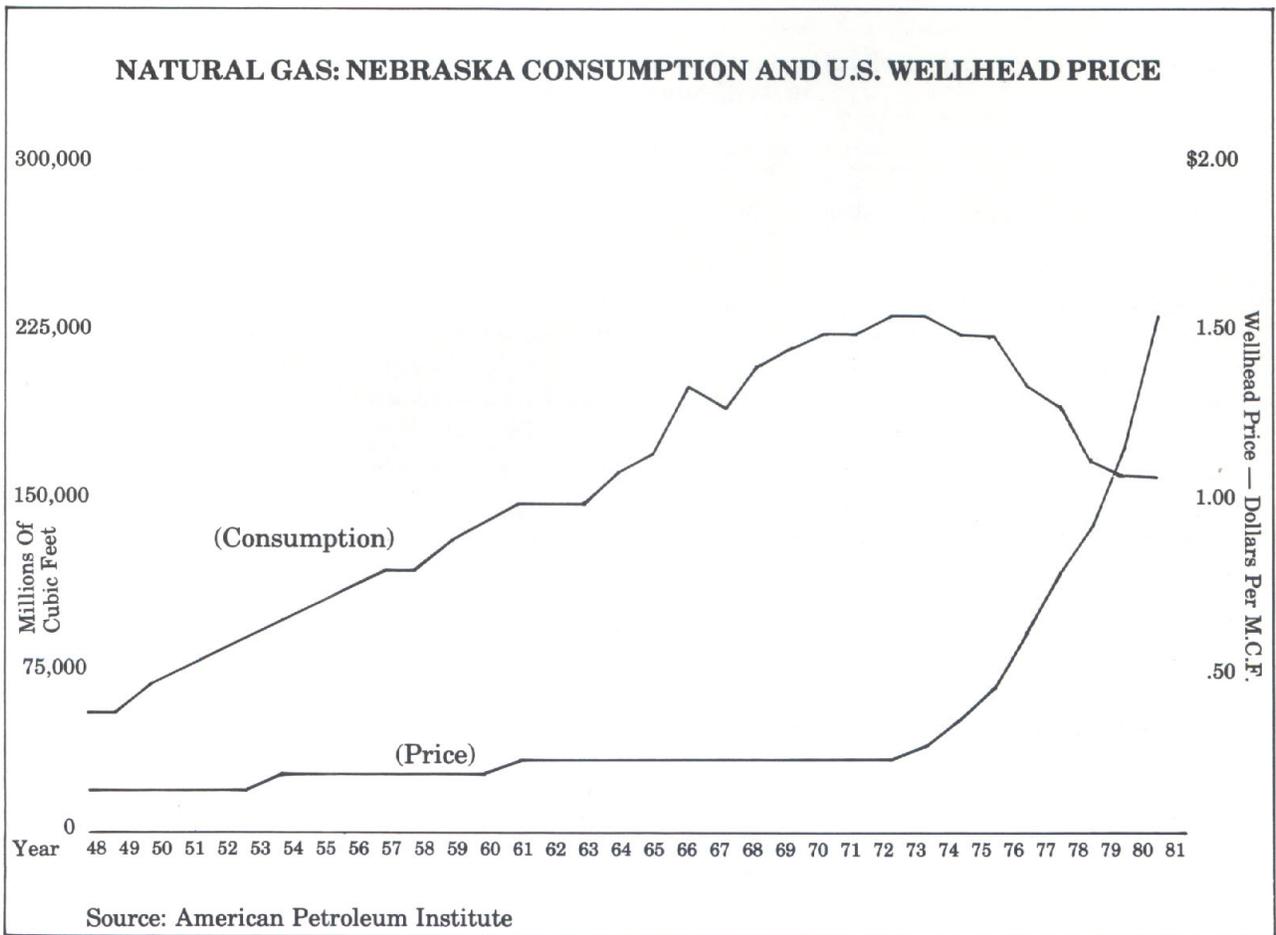


Table 19

# nebraska energy consumption

Table 19 presents revised 1979 Nebraska energy consumption figures by fuel type and major consuming sector. The totals of each fuel type are derived from existing reporting forms and are relatively accurate. Information on the agricultural, industrial, commercial and residential sectors is estimated. However, even direct reported data has limited accuracy. For example, gasoline imported to the state, less exports, does not necessarily equal the amount which was consumed for the same time period. A substantial

difference can be introduced by putting in or withdrawing fuel from storage.

Table 20 contains similar information estimated for 1980. At the time this report was prepared, fuel type and consumption information was available for only 6-10 months of 1980. The energy use estimate for the balance of 1980 is based on the seasonal patterns of previous years. As additional information becomes available this table will be revised in reports for the first and second quarters in 1981.

**1979 Nebraska Energy Consumption by Fuel Type and Consuming Sector (Revised)  
in Trillions (10<sup>12</sup>) BTU**

Fuel Type	Conversion Factor	Electric Utilities	Residential	Commercial	Industry	Agriculture	Transportation	Total	%
Coal	22.56 10 <sup>6</sup> BTU/t	75.5	—	0.1	12.5	—	—	89.1	15.7
Natural Gas	.994 10 <sup>6</sup> BTU/mcf	13.9	49.5	33.0	48.7	11.6	—	156.7	27.6
Motor Gasoline	0.12495 10 <sup>6</sup> BTU/gal	—	—	0.4	1.0	3.0	108.5	112.9	19.9
Aviation Fuel	0.1334 10 <sup>6</sup> BTU/gal	—	—	—	—	—	5.7	5.7	1.0
<b>Liquified</b>									
Petroleum Gas	0.09955 10 <sup>6</sup> BTU/gal	—	8.3	1.3	3.7	6.1	0.3	19.7	3.5
Other Petroleum	0.1387 10 <sup>6</sup> BTU/gal	4.6	10.3	8.4	6.7	27.6	19.8	77.4	13.7
Nuclear		92.3	—	—	—	—	—	92.3	16.3
Hydro		13.0	—	—	—	—	—	13.0	2.3
Electricity	3413 BTU/kWh	45.6	18.0	13.7	7.4	6.5	—	NA	
		(sales)							
<b>Total</b>		154.7	86.1	56.9	80.0	54.8	134.3	566.8	100
<b>%</b>		27.3	15.2	10.0	14.1	9.7	23.7	100	

Notes: Sum of components may not equal total due to independent rounding.

In order to get physical units, divide the BTU by the corresponding conversion factor.

Source: Nebraska Energy Office, December, 1980

08F

Table 19

**1980 Nebraska Energy Consumption by Fuel Type and Consuming Sector  
in Trillions (10<sup>12</sup>) BTU**

Preliminary estimates based on data available for 6-10 months of 1980

Fuel Type	Conversion Factor	Electric Utilities	Residential	Commercial	Industry	Agriculture	Transportation	Total	%
Coal	22.56 10 <sup>6</sup> BTU/t	107.8	—	0.2	4.2	—	—	112.2	20.7
Natural Gas	.994 10 <sup>6</sup> BTU/mcf	11.8	49.5	33.1	48.8	11.7	—	154.9	28.6
Motor Gasoline	0.12495 10 <sup>6</sup> BTU/gal	—	—	0.4	1.0	3.0	97.6	102.0	18.9
Aviation Fuel	0.1334 10 <sup>6</sup> BTU/gal	—	—	—	—	—	5.2	5.2	1.0
<b>Liquified</b>									
Petroleum Gas	0.09955 10 <sup>6</sup> BTU/gal	—	6.8	1.1	3.0	5.2	—	16.1	3.0
Other Petroleum	0.1387 10 <sup>6</sup> BTU/gal	2.2	9.5	7.9	6.2	25.7	19.9	71.4	13.2
Nuclear		65.0	—	—	—	—	—	65.0	12.0
Hydro		14.3	—	—	—	—	—	14.3	2.6
Electricity	3413 BTU/kWh	47.2	19.0	12.1	8.5	7.6	—	NA	
		(sales)							
<b>Total</b>		153.9	84.8	54.8	71.7	53.2	122.7	541.1	100
<b>%</b>		28.4	15.7	10.1	13.3	9.8	22.7	100	

Notes: Sum of components may not equal total due to independent rounding.

In order to get physical units, divide the BTU by the corresponding conversion factor.

Source: Nebraska Energy Office, December, 1980

11F

Table 20

# energy for irrigation study

Nebraska is an agricultural state. Because half of the energy used in agriculture is consumed by irrigation, the Nebraska Energy Office developed its largest survey of 1980 to determine the amounts and types of energy used by irrigators. Of the 8,748 questionnaires mailed, 3,384 were returned and 2,455 had

good answers on most questions. The answers were entered into a computer for sorting and calculations.

Analysis of the responses showed 4.24 pumps per operator/farmer in the survey; a higher figure than expected. The average operator manages 387 acres.

## ENERGY USE FOR IRRIGATION BY FUEL TYPE

Fuel used	No. of Responses	Acres per Pump	Million Btu/acre	Million Btu/pump
Diesel	661	121.5	4.20	510
Propane	248	81.9	2.89	237
Gasoline	16	64.2	1.81	116
Natural Gas	93	104.1	4.61	481
Electricity	272	78.1	0.90	70
Mixture of Fuels	1,088	84.6	3.22	273
<b>AVERAGE</b>		91.2	3.32	303

The survey revealed that 45.8 percent of the operators use more than one type of fuel. Electricity-driven pumps use 3.7 percent times less Btu per acre because of the higher efficiency of electric motors compared with internal combustion engines. (Electric pumps are still more efficient even with a two-thirds energy loss from the production and transmission of electricity from electric utilities.)

Those farms with gasoline engines usually have the smallest acreage per pump (small system, low pumping pressure). Farms with the highest acreage per pump have diesel and natural gas irrigation plants. These farms also have the highest Btu use per acre and per unit. Probably more center pivot irrigation systems use diesel and natural gas than electricity and propane.

Assuming that the sample is representative, with data from the table an estimate of Nebraska irrigation energy use in 1979 can be calculated.

a) In proportion of irrigated land:

$$\text{Energy for Irrigation (EFI)} = 3.32 \text{ million Btu/Acre} \times 7,485,081 \text{ acres} = 24.9 \text{ trillion Btu.}$$

It is close to 25 trillion Btu. This calculation is on the high side because the irrigated land estimates include some unknown amount of land reported twice. Such duplication occurs when irrigation can be done from two sources; from wells and from open sources (river, channel, pond, etc.). An estimated 770,000 acres are irrigated by syphon tubes or gravity and need no outside energy source. After adjustment for this acreage EFI is estimated at 22.3 trillion Btu.

b) In proportion to irrigation wells, assuming that one well has one pump:

$$\text{EFI} = 303 \text{ million Btu/pump} \times 63,821 \text{ wells} = 19.3 \text{ trillion Btu.}$$

This calculation is clearly on the low side because irrigation takes place not only from wells, but also from open sources.

The probability exists that some respondents included reuse pumps as main pumping units so that the average energy use per pumping plant in this survey is lower than the average for the state.

The same data was sorted in such a way that any difference in energy consumption between different systems would be shown in the following table:

## ENERGY USE FOR IRRIGATION BROKEN DOWN BY SYSTEM TYPE

System Type	No. of Records	Acres per Pump	Million Btu/acre	Million Btu/pump
Center pivot	646	128.2	3.94	504
Side roll and towline	67	98.4	3.15	310
Solid set	16	69.6	0.65	45
Big gun and traveler	43	102.3	2.28	234
Hand move	35	56.5	2.05	116
Gated pipe	682	68.2	2.92	199
Combination of several systems	873	86.6	3.12	270
<b>AVERAGE</b>		91.2	3.32	303

Table 21

Table 21 shows that the center pivot irrigation system, the most popular one in recent years, is at the same time the most energy intensive system. The addition of one new center pivot system requires 0.5 billion Btu in a year similar to 1979, or about 4 million Btu per irrigated acre. The solid set system is the least energy intensive, however, the number of responses on this system was the smallest.

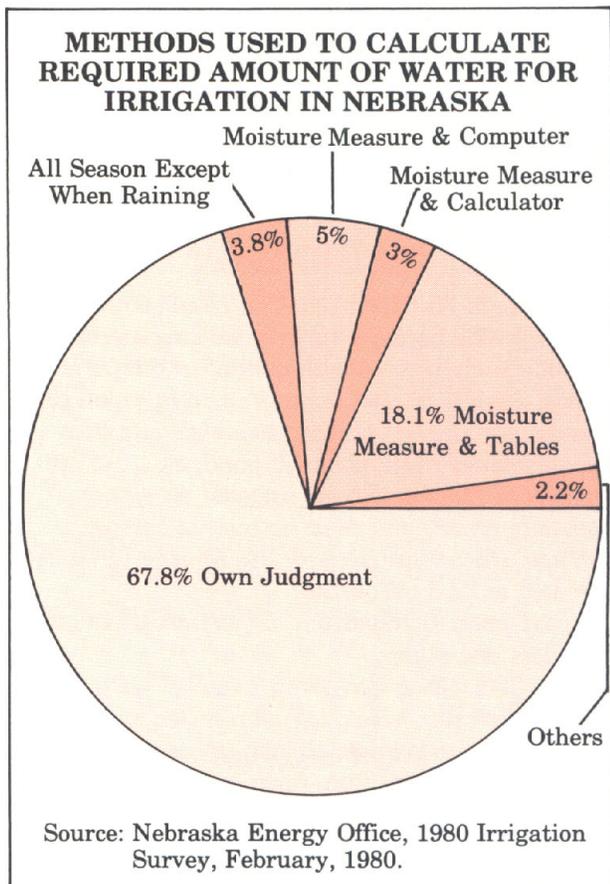


Figure 2

The pie chart (Figure 2) shows that more than 70 percent of irrigators do not use the soil moisture measurement but rather rely on their own judgment to calculate the amount of water needed for irrigation. University of Nebraska Professors Paul Fischback and Tom Thompson found that computer scheduling of irrigation can save up to 20 percent of both water and energy and another 15-20 percent can be saved by using water management techniques (reuse systems).

At the time of the study only 26-28 percent of irrigators used irrigation scheduling. Up to 14 percent of total energy used for irrigation could be saved if this method were used by all irrigators.

Greater use of electricity for irrigation (as in California) could save a large amount of the diesel fuel now consumed in irrigation. The change from diesel fuel to electricity for pumping irrigation water, though economically feasible, will require a large investment and use of electric load levelling (management) techniques.

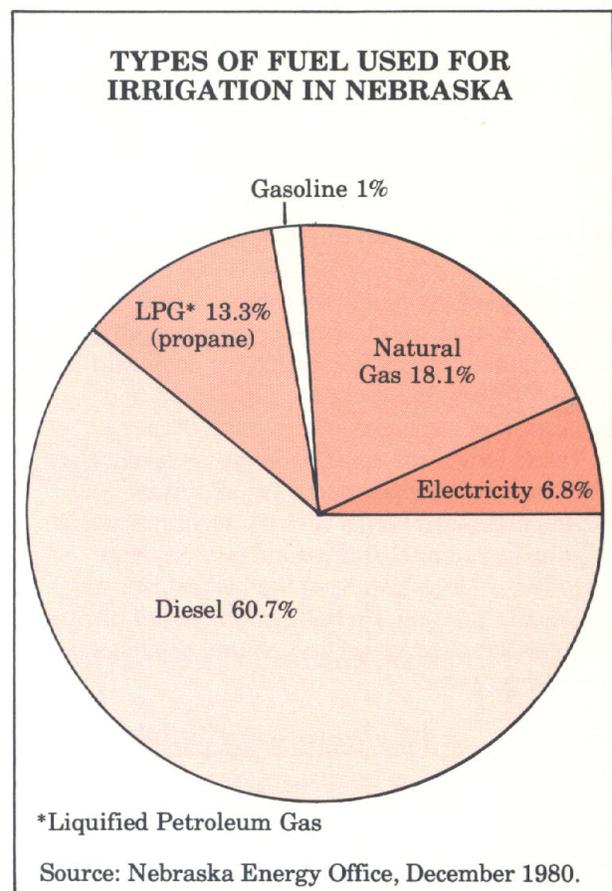
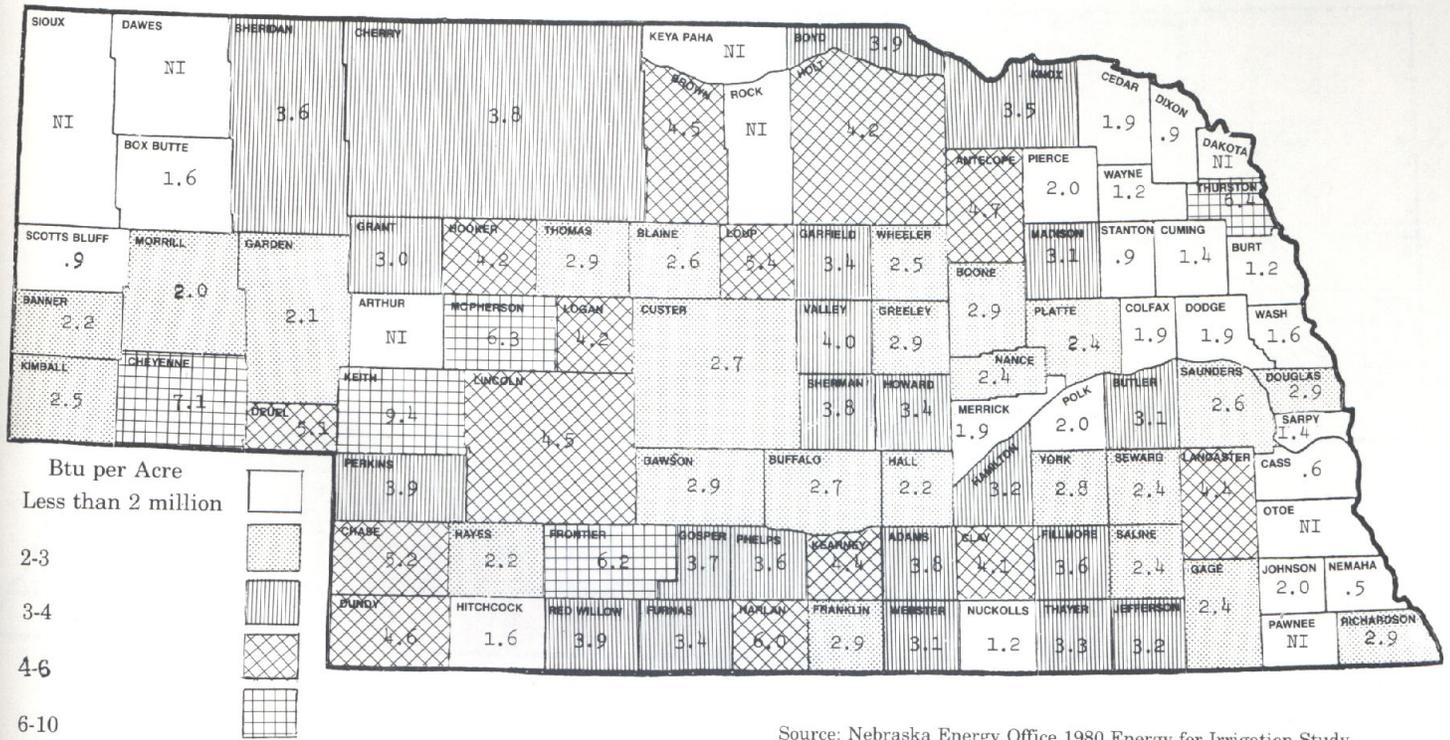


Figure 3

The above pie chart also presents the relative share of different fuels used for irrigation. Diesel fuel is clearly used the most. However, only 0.9 million Btu per acre is required when an electric motor is used compared with 4.2 million Btu per acre when an irrigation pump is driven by a diesel engine.

**Energy Used for Irrigation of One Acre in 1979 in Nebraska by County  
(All Types of Energy are Included)  
Million (10<sup>6</sup>) Btu Per Acre**



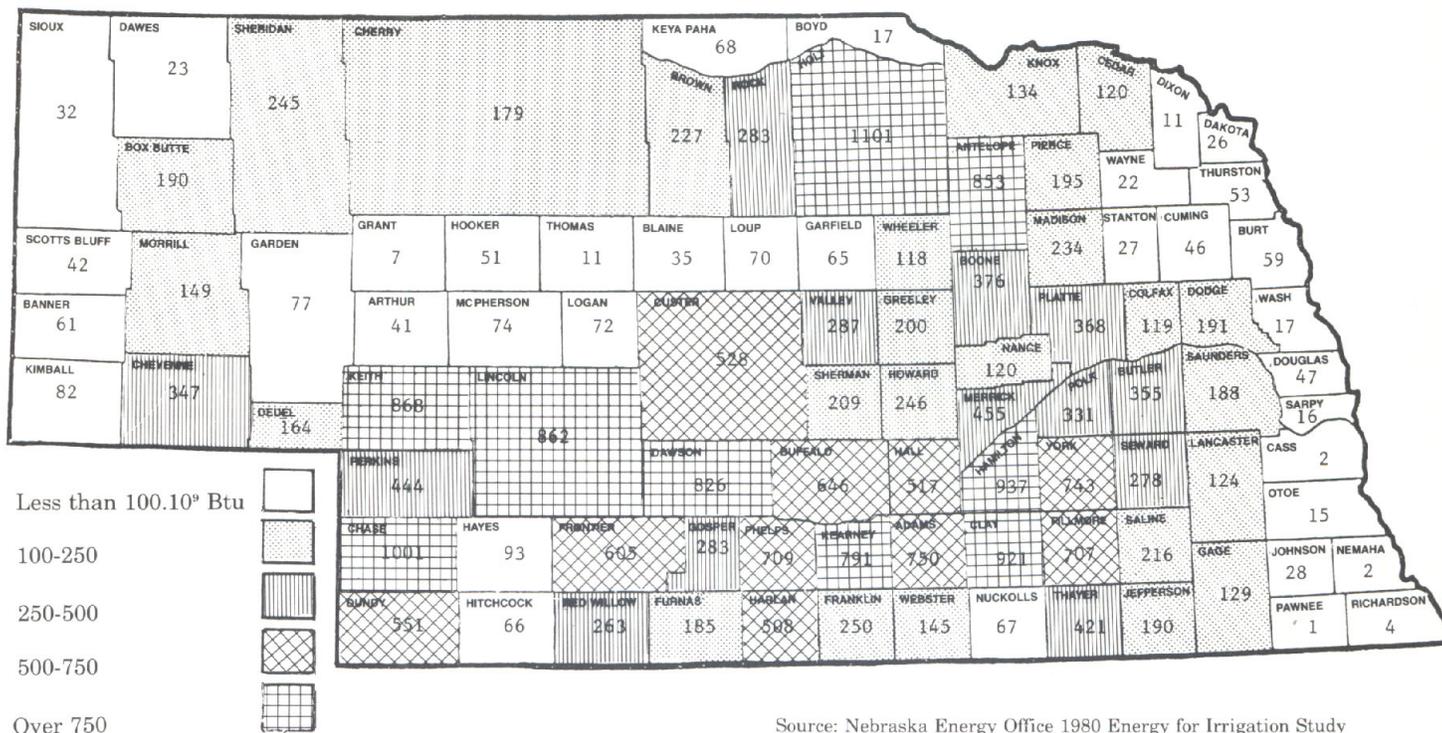
Source: Nebraska Energy Office 1980 Energy for Irrigation Study

NI No Information

Using this data average energy use in millions of Btu per irrigated acre was calculated for each county. This amount was multiplied by the number of irrigated acres as estimated by the state well registration system as of December 31, 1979. The product is the estimated energy consumption by irrigation

pumps in each county. The maps show clearly the great differences between counties in energy use for irrigation. This information will be important for the fuel allocation program and energy emergency planning.

### 1979 Estimated Energy Use For Irrigation by County Billion (10<sup>9</sup>) of Btu



Source: Nebraska Energy Office 1980 Energy for Irrigation Study

Data from the study was stored in the computer by county number to allow sorting and calculations to determine how much energy is used for irrigation in each of 93 Nebraska counties. The county shown on the mailing address was assumed to be the county

where all irrigation fields of the operator were located. Of course, some operators have irrigated land in several counties but there was no way to make this separation.

# budget operations:

## A Comparison of Expenditures for Calendar Years 1979 and 1980

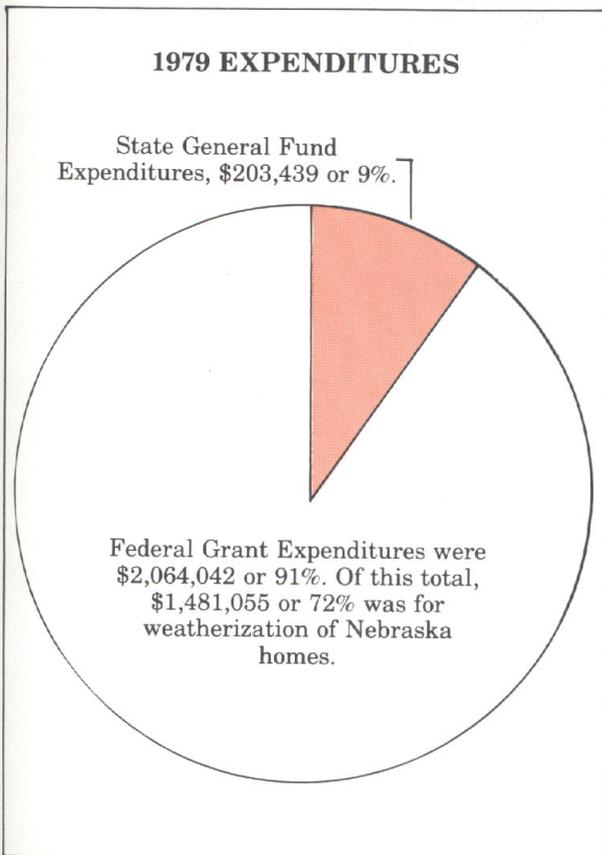
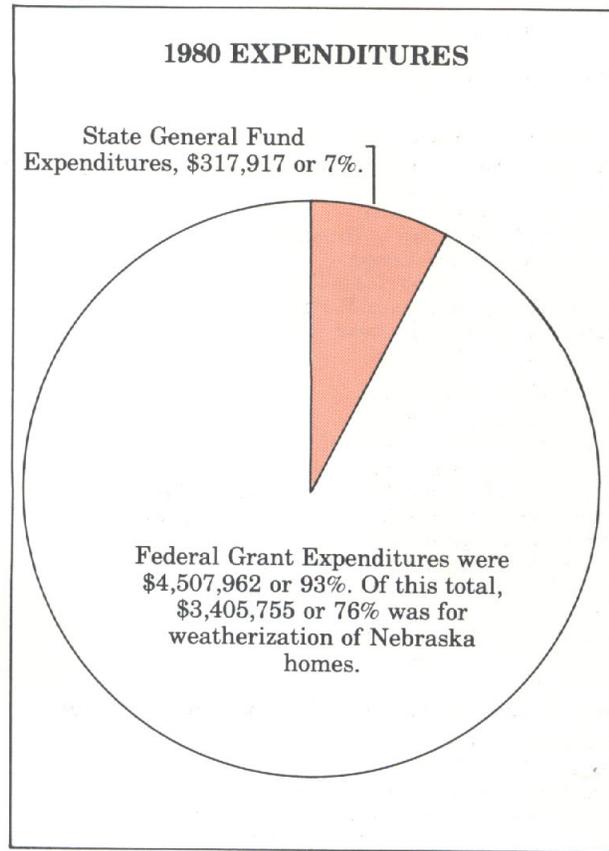
The Nebraska Energy Office has two funding sources, the State General Fund appropriation and the federal government. The major federal government source is the Department of Energy. Other federal sources include the Old West Regional Commission and the Mid-American Solar Energy Complex.

The following expenditure breakout and comparison, by fund and calendar year, is broken into three categories:

1) **SALARY EXPENDITURES** include total costs for wages and fringe benefits (social security, state retirement program, health and life insurance).

2) **OPERATING EXPENDITURES** include total costs for operating expenses such as postage, printing, data processing, building rent, utilities, consultants, office supplies, travel expenses and capital outlay equipment.

3) **CONTRACT EXPENDITURES** include total costs for contracts with outside sources such as community action agencies, Nebraska Inter-Tribal Development Corporation, State Solar Office, 4-H Development Association and the University of Nebraska.



Description	1979	1980	% Increase
<b>STATE GENERAL FUND:</b>			
Salary Expenditures	\$ 144,713	\$ 248,601	72%
Operating Expenditures	58,726	69,316	18%
Sub-Total	\$ 203,439	\$ 317,917	56%
<b>FEDERAL FUND:</b>			
Salary Expenditures	\$ 226,299	\$ 397,212	76%
Operating Expenditures	144,675	303,808	110%
Contract Expenditures	1,693,068	3,806,942	125%
Sub-Total	\$2,064,042	\$4,507,962	119%
Totals	\$2,267,481	\$4,825,879	113%

# nebraska energy office employees

## **Director**

William H. Palmer

## **Deputy Director**

V. B. Balok

## **Administrative Staff**

Business Manager: Michael Wolverton  
Auditor: Robert L. Poehler  
Personnel: Barbara J. Rowen  
Accounting Clerk: Debbie L. Thomas  
Technical Advisor: Kirk Conger  
Public Information Officer: Diana King  
Administrative Secretary: Gail R. Hackwith  
Secretary II: Peggy E. Gochmour  
Secretary I: Joyce M. Remppe

## **Conservation Programs**

Director: Lawrence E. Riegel  
Residential Coordinator: Mardel K. Meinke  
Administrative Assistant: Ann Brockhoff  
Conservation Program Administrator: Robert W. Leavitt  
Conservation Program Administrator: Gary L. Nystedt  
Conservation Program Administrator: Teri S. Tuma  
Conservation Program Administrator: Peter S. Davis  
Lincoln-Based Weatherization Specialist: Robert H. Wilson  
Grand Island-Based Weatherization Specialist: David E. Harris  
Student Intern: Ronald W. Short  
Joy Deknatel

## **Energy Extension Service, Educational Programs and Emergency Planning**

Manager: Gary A. Lay  
Education Coordinator: Larry Scharmann  
Auto Efficiency Specialist: Michael W. Robertson  
Chris A. Mason

## **Institutional Building Grants Program**

Manager: David T. Glaze  
Assistant Manager: Daniel A. Berlowitz  
Program Supervisor: Janice L. Knight  
Lincoln-Based Auditors:  
Shane A. Myers  
Sim Gurewitz  
James A. Wiseman  
Randy G. Schantell

## **Omaha-Based Auditors:**

Adelay Idler  
Bradford C. Cummings  
Frank J. Podkul

## **Grand Island-Based Auditors:**

Gary L. Folk  
Lane Leisinger

## **North Platte-Based Auditor:**

Jeff Morgan

## **Fuel Allocation Program**

Manager: L. Leonard Pewthers  
Fuel Allocations Technician: Robert M. Morley  
Office Clerks: Gordon E. Ayers  
Claire M. Royal

## **Energy Data Section**

Manager: Ronald A. Konecny  
Statistical Analysts: Nikolai A. Rudakov  
Betty E. Badberg

## **NEBRASKA SOLAR OFFICE**

Director: Robert J. Youngberg  
Extension Programs Coordinator: James J. Bowman  
Solar Systems Engineer: Paul P. Popinchalk  
Project Coordinator: Nancy J. Nilson  
Secretary III: Bonnie Vetter  
Secretary II: Susan Wilcox  
Secretary I (part-time): Jennifer Schizas  
Student Worker (part-time): Martha Stephens  
Graduate Research Assistant (part-time): Mehdi Ashjaee  
Research Technician (part-time): Pierre Benyamin



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