

*Energy
and
Nebraska*

Prepared for
The Honorable Robert Kerrey

June 1983



Table of Contents

	Page
I. Energy and Nebraska	4
II. Energy Sources	11
A. Coal	11
B. Petroleum	12
C. Hydroelectricity	13
D. Electric Generation	15
1. Coal	15
2. Nuclear	16
E. Natural Gas	17
III. How the Energy is Used	19
A. Residential	19
B. Agricultural	21
1. Field Operations	22
2. Irrigation	25
3. Grain Drying	27
4. Other Uses	27
5. Estimated Energy Needs for 1983.	29
C. Commercial	32
D. Industrial	35
E. Transportation	38
F. Summary Table	41
IV. Summary	43
V. Appendices	44
A. Conversion Table (Physical Units to Btu)	44
B. Electric Generation and Transmission Facilities	45

Tables

	Page
Nebraska Energy Use by Sector (%)	7
Nebraska Electricity Generation	
Allocated to End Use (%)	10
Nebraska Energy Use by Fuel Type.	11
Coal Fired Generating Plants.	15
Heating Degree Days	20
Planted Area by Crop Type	22
Energy for Field Operations	22
Energy for Irrigation	25
Energy for Grain Drying	27
Other Agricultural Energy Use	29
Estimated Agricultural Energy Needs in 1983	29
Commercial Sector Use by Fuel Type.	33
Industrial Sector Use by Fuel Type.	36
Gasoline and Super Unleaded with	
Ethanol Availability	39
Utilization of Energy in Nebraska	41

Charts

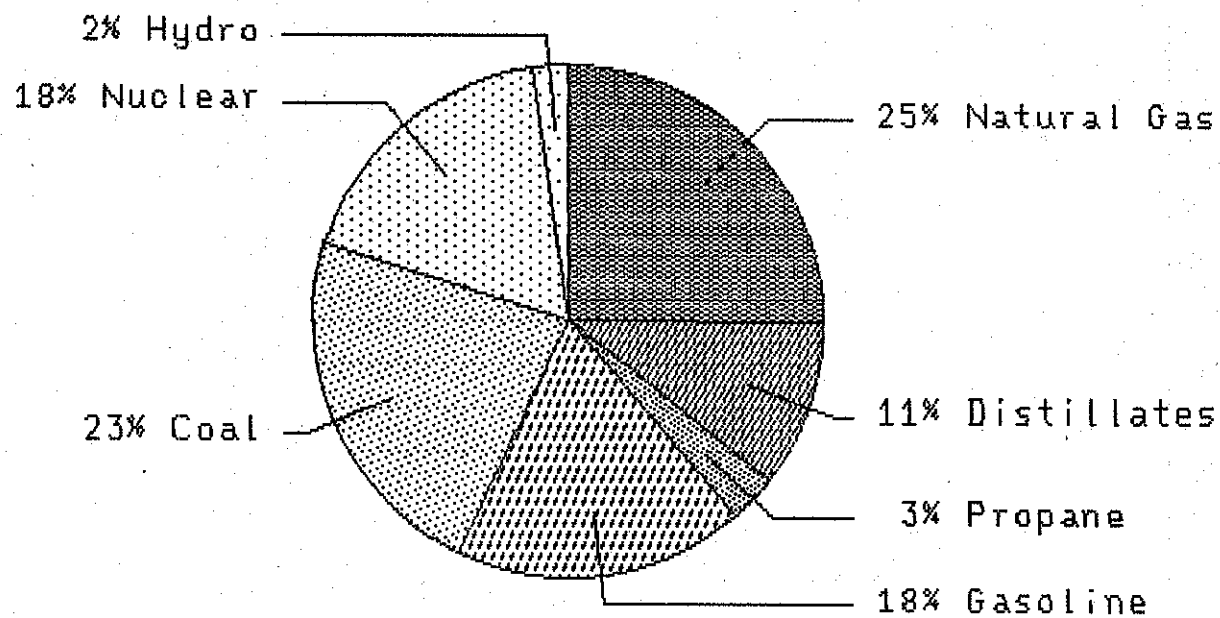
	Page
Nebraska Energy Use by Fuel Type 1982	5
Nebraska Energy Use by Sector 1982.	8
Nebraska Energy Use by Fuel Type 1978-1982.	9
Planted Area by Crop Type	23
Energy for Field Operations 1981-83	24
Energy for Irrigation 1981-82	26
Energy for Grain Drying 1981-82	28
Other Agricultural Energy Use 1981-82	30
Total Agricultural Energy Use 1981-83	31
Commercial Sector Use by Fuel Type 1978-1982.	34
Industrial Sector Use by Fuel Type 1978-1982.	37
Gasoline and Super Unleaded with Ethanol (Gasohol) Use 1978-1982.	40

I. ENERGY AND NEBRASKA

Energy in Nebraska is derived primarily from five basic sources: oil, natural gas, coal, nuclear power, and hydro power. Refined petroleum products are the single largest contributor of energy consumed in Nebraska and accounted for 32% of the energy consumed in the state in 1982. Natural gas was the second largest source of energy, comprising 25% of the total energy consumed, and coal was the third largest energy source, providing just under 23% of the energy consumed in 1982. Eighteen percent of Nebraska's energy was provided by nuclear power, and hydro power accounted for the last 2% of the energy used in Nebraska.

Only small amounts of the various natural resources mentioned above are available in Nebraska for energy production. This means that most of Nebraska's energy must be imported. Alternate energy sources hold some promise for the future, although in 1982 alternates such as solar, wind, biomass, geothermal and alcohol fuels provided less than 1% of the energy consumed in Nebraska. Among these alternates, the ethanol portion of gasohol accounted for approximately 1% of the fuel used by motor vehicles. To date, this is the most promising alternate source of energy.

Nebraska Energy Use by Fuel Type - 1982



At this time, only 9-10% of Nebraska's total energy requirements are met from in-state resources. Out of 35 million barrels of petroleum products (motor fuels, propane and distillates--diesel, heating oil, kerosene and other similar fuels) used in the state in 1982, Nebraska produced nearly 7 million barrels of crude oil which were exported from the state for refining. Therefore, although 20% of the yearly petroleum requirement originates in the state before being exported for refining, Nebraska imported all 35 million barrels of petroleum products consumed. Of the 135 billion cubic feet of natural gas consumed in Nebraska in 1982, only 2.5-3.0 billion cubic feet (2% of gas required) were produced in Nebraska. Coal and uranium were imported into the state for the generation of electricity, but hydro power originating in the state generated 2.1% of the state's total electricity requirement.

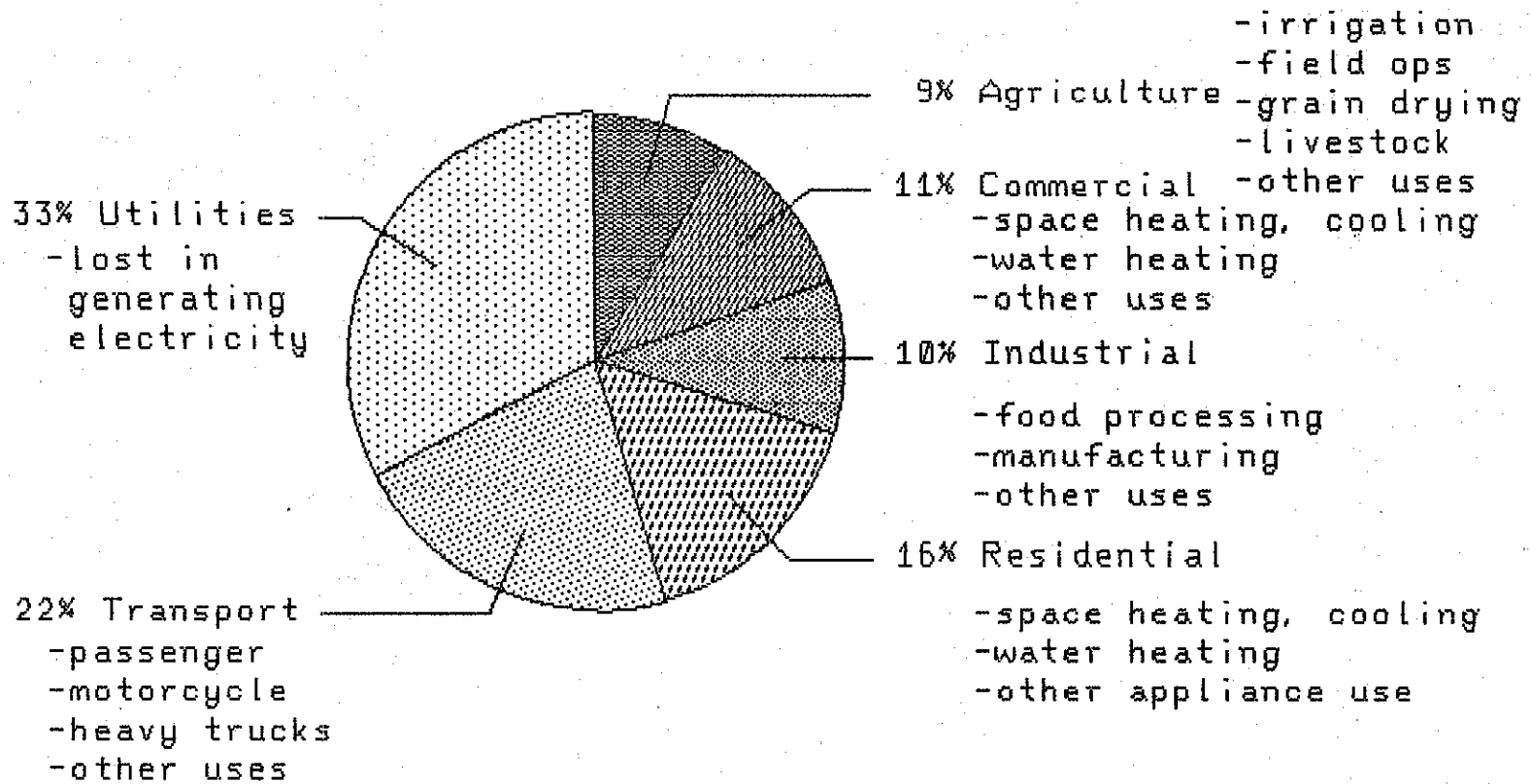
Nebraska Energy Use by Sector
(In Percentages)

	1978	1979	1980	1981	1982
Agriculture	9.5	9.7	9.4	9.2	8.7
Commercial-Government	9.9	10.0	10.9	10.2	10.5
Industrial	14.2	14.1	11.5	11.4	9.9
Residential	14.9	15.2	15.9	15.1	15.8
Transportation	27.2	23.7	23.4	22.6	21.7
Utilities (generation and transmission)	24.3	27.3	28.9	31.5	33.4
	100.0	100.0	100.0	100.0	100.0
Total use (Trillion Btu)	560.3	571.8	540.1	511.6	533.8

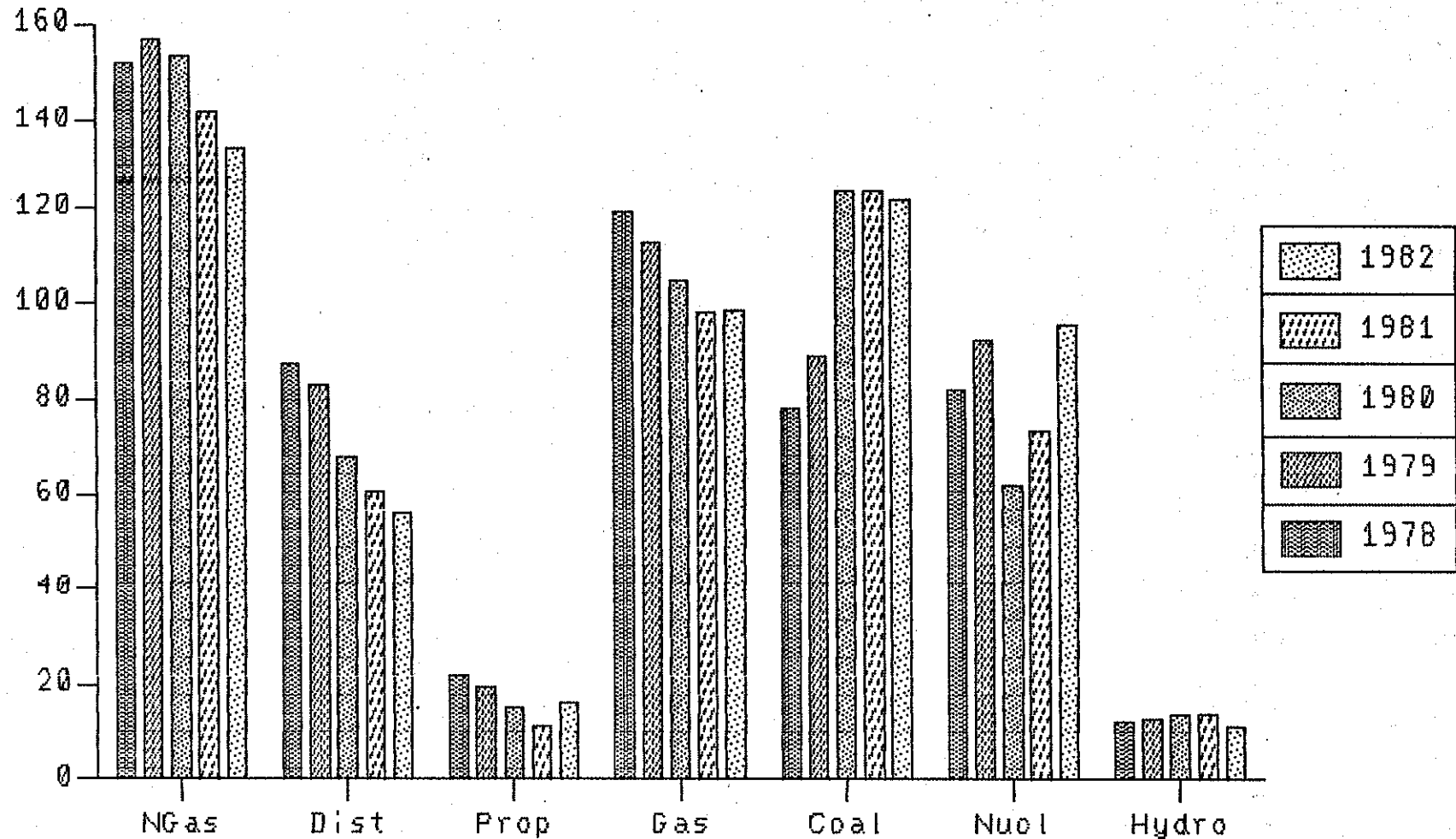
Use by utilities represents energy losses incurred during the generation and transmission of electricity which now account for about one-third of Nebraska's energy use, up from about one-fourth in 1978. This increase follows Nebraska's growing reliance on electricity as a convenient and versatile energy supply.

It should be noted that electricity is generated from sources that are often impractical or impossible as a direct energy source (coal, uranium and hydro power). Moreover, electrical generation and transmission losses are easily computed while energy losses attributable to the end use inefficiencies of petroleum or natural gas are highly variable and speculative. The table on page ten includes these losses, distributed proportionally among the other five end use sectors as part of the energy usage of these sectors.

Nebraska Energy Use by Sector - 1982



Nebraska Energy Use by Fuel Type Trillion Btu



Nebraska Energy Office
May 27, 1983

Nebraska Electricity Generation Allocated to End Use
(In Percentages)

	1978	1979	1980	1981	1982
Agriculture	13.7	13.5	12.2	12.3	11.8
Commercial-Government	17.5	18.2	19.5	19.6	20.2
Industrial	19.1	18.6	17.3	18.0	16.4
Residential	22.5	26.0	27.6	27.5	29.9
Transportation	27.2	23.7	23.4	22.6	21.7
	100.0	100.0	100.0	100.0	100.0

Source: Nebraska Energy Office, Annual Reports.

II. ENERGY SOURCES

The following table presents energy use by fuel type for the state of Nebraska for 1982.

Nebraska Energy Use by Fuel Type in 1982:

<u>Fuel Type</u>	<u>(Trillions Btu)</u>	<u>Physical Units</u>
Natural gas	134.2	135.0 Billion cubic feet
Distillates	56.1	406.1 Million gallons
Propane	16.2	169.5 Million gallons
Gasoline	98.6	788.5 Million gallons
Coal	121.6	5.392 Million tons
Nuclear	95.7	NA
Hydro	11.4	NA
<u>Total</u>	<u>533.8</u>	

Source: Nebraska Energy Office, Annual Report 1982.

Note: Nearly all of the coal (5% of coal was used in industry) and all of the nuclear and hydro power was used in the generation of electricity. Consumption of electricity was 45.7 trillion Btu's (13,384 million kwh).

A. Nebraska Coal

An estimated 7.5 billion tons of coal underlie extreme southeastern Nebraska at depths of 2,000 feet or more. This coal has been considered uneconomical to mine. It is of bituminous grade and of relatively high sulfur content. The field extends into Iowa and Kansas where the coal lies closer to the surface and is mined.

B. Nebraska Petroleum.

Nebraska's proved petroleum reserves are estimated at 40 to 45 million barrels, lying mostly in the Panhandle. Some natural gas occurs with these deposits. Proved petroleum reserves are defined as the estimated amount of crude oil which geological and engineering data demonstrate with reasonable certainty to be recoverable from known reservoirs under existing economic and operating conditions. Thus, proved petroleum reserves constitute a conservative and practical economic measure of Nebraska's petroleum resource.

It is likely that there is physically a great deal more petroleum underlying the state than the proved reserve reveals. Although no Nebraska-specific estimates are hazarded, the United States Geological Survey made estimates in 1981 of the physical presence of petroleum within the four geological basins that converge in Nebraska. Those estimates are:

	Millions of barrels
Denver Basin (Nebraska Panhandle, eastern Wyoming and eastern Colorado)	200 - 1,800
Cambridge Arch (central Nebraska, central Kansas and northern Oklahoma)	100 - 1,000

Nemaha Ridge
(Richardson County, Nebraska,
eastern Kansas, eastern Oklahoma
and northwestern Arkansas)

negligible - 200

Salina Basin
(eastern half of Nebraska and
north central Kansas)

0 - negligible

Oil was first produced in southeast Nebraska, however, near Falls City in 1939. Currently there are 19 producing wells in this Richardson County area. This crude oil is not refined but rather is used directly as boiler fuel. Most of Nebraska's production is in Cheyenne, Kimball, Banner, Morrill, and Scotts Bluff counties in the Panhandle, and in Hitchcock County and Red Willow (the largest oil producing county in Nebraska) both in the southwest. The top production year was 1962 when almost 25 million barrels were produced. In 1973, about 7 million barrels were recovered. Production dropped to just over 6 million barrels in 1979 and has since rebounded to 6.9 million barrels in 1982.

Nebraska's crude oil is refined in neighboring states. There was one refinery in the state, at Scottsbluff, with a capacity of 5,000 to 5,400 barrels per day, but this refinery was closed in 1982.

C. Hydroelectricity

Nebraska has 20 operating hydroelectric plants, 10 of which are rated 5 megawatts or more. The smaller units are of questionable economic value because of the expense of maintaining an operating crew. A new plant, named Kingsley,

is being built at Lake McConaughy. The Kingsley hydro will be rated at 50 megawatts, maximum, and is scheduled to be operational in 1984. The Nebraska Energy Office and the Nebraska Municipal Power Pool have recently completed an initial engineering analysis of seven additional hydro sites. From this study it appears that three sites have significant potential for development. These three are at the Harlan County reservoir, the Merritt Dam near Valentine, and the Calumus Dam near Burwell which is currently under construction as a flood control and irrigation project. Preliminary calculations on all three of these potential projects showed benefit cost ratios of at least 2.0. The total capacity of all hydro facilities in Nebraska is 131.15 megawatts.

These ratios are subject to variability because other uses for the water impounded may have precedence. These figures represent capability, assuming reservoirs are full and river flow is available. Obviously a full reservoir is not compatible with flood control and if water is drawn off upstream for irrigation, it is not available for power generation. Should hydro development proceed, these conflicting demands must be considered in planning electrical use.

The prevailing philosophy for scheduling generation in Nebraska is to make use of the most economic steam plants for the base load required by a system, and to use hydro capacity to supply the peak loads which occur for short periods during the daily load variation.

D.1. Electric Generation--Coal

There are ten coal fired electric generating stations owned in whole or in part by Nebraska electric utilities. The following table lists the owner, location, and nameplate rating (the capacity rating assigned by the manufacturer of the generator) of these stations.

<u>Coal Fired Generating Plants</u>			
<u>Owner</u>	<u>Location</u>	<u># of Units</u>	<u>Total Nameplate Rating</u>
1) NPPD	Kramer Station, Bellevue	3	135.5 Megawatts
2) NPPD	Sheldon Station, Hallam	2	227 Megawatts
3) NPPD	Gentleman Station, Sutherland	2	1278 Megawatts
4) OPPD	North Omaha Station, Omaha	5	644.7 Megawatts
5) OPPD	Nebraska City Station, Nebraska City	1	565 Megawatts
6) LES *	Laramie River Station Wheatland, Wyoming	3	183 Megawatts
7) Fremont	Wright Station, Fremont	3	129 Megawatts
8) Grand Island	Platte River Station, Grand Island	1	100 Megawatts
9) Hastings	Hastings Energy Center	1	76.3 Megawatts
10) Alliance	Alliance	4	16.5 Megawatts

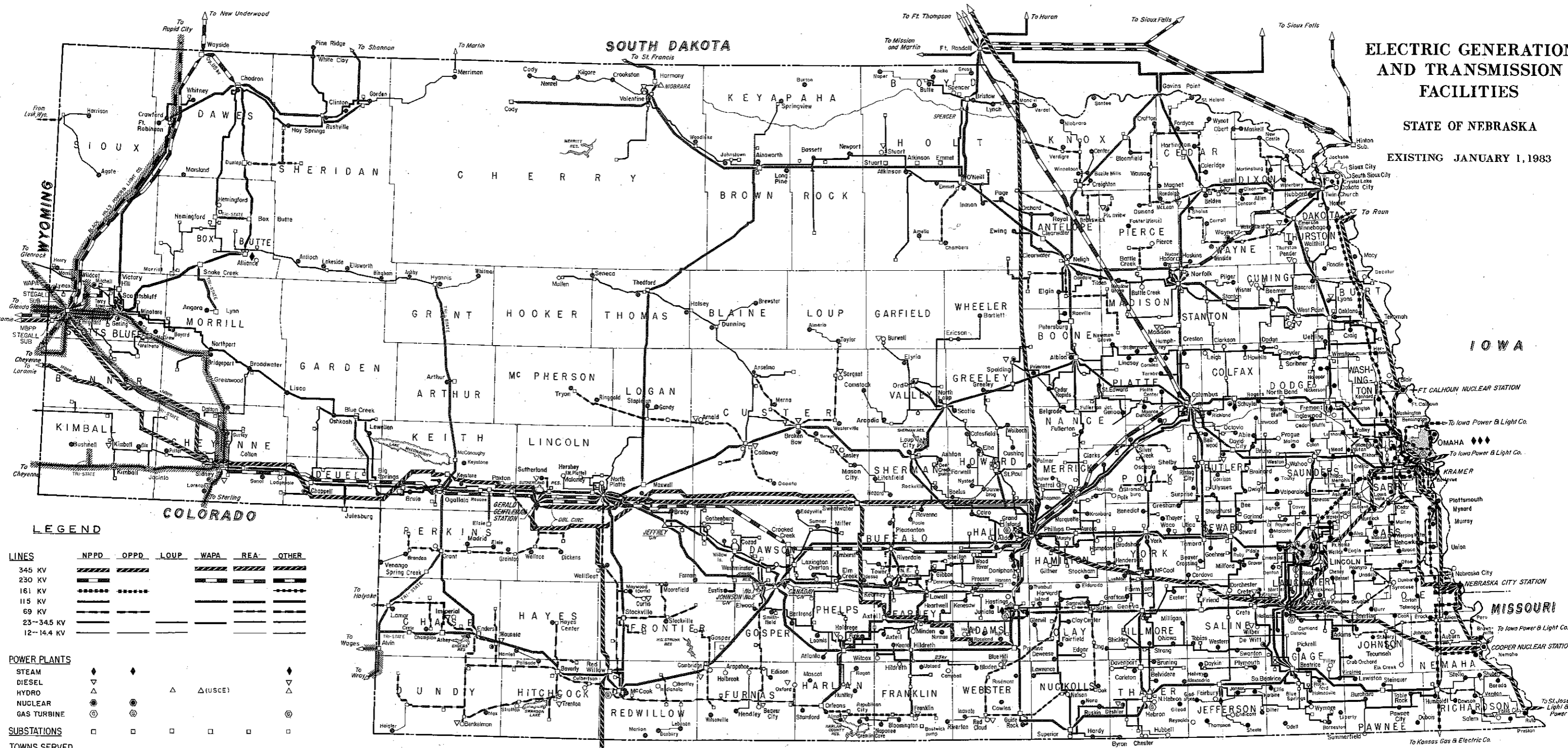
(At the Alliance plant natural gas is the primary fuel used with coal as an alternate source of fuel.)

* LES owns 10.5% of the output. There are three 550 megawatt units at Laramie River Station. Basin Electric is the largest shareholder and is the operator of the facility.

ELECTRIC GENERATION AND TRANSMISSION FACILITIES

STATE OF NEBRASKA

EXISTING JANUARY 1, 1983



LEGEND

LINES	NPPD	OPPD	LOUP	WAPA	REA	OTHER
345 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
230 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
161 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
115 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
69 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
23-34.5 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬
12-14.4 KV	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬	▬▬▬▬▬▬

POWER PLANTS	NPPD	OPPD	LOUP	WAPA	REA	OTHER
STEAM	◆	◆	◆	◆	◆	◆
DIESEL	▽	▽	▽	▽	▽	▽
HYDRO	△	△	△	△	△	△
NUCLEAR	⊙	⊙	⊙	⊙	⊙	⊙
GAS TURBINE	⊙	⊙	⊙	⊙	⊙	⊙

SUBSTATIONS	NPPD	OPPD	LOUP	WAPA	REA	OTHER
RETAIL	□	□	□	□	□	□
WHOLESALE	○	○	○	○	○	○

Notes: Abbreviations in legend show ownerships as follows:
 NPPD - Nebraska Public Power District, HQ at Columbus.
 OPPD - Omaha Public Power District, HQ at Omaha.
 LOUP - Loup Power District, (Serves "Four-County Area"), HQ at Columbus.
 WAPA - Western Area Power Administration.
 REA - Rural Electrification Administration. (Facilities of rural electric borrowers).
 OTHER - Facilities owned by municipalities and others as shown.
 USCE - U.S. Corps of Engineers. (Missouri River hydro plants).
 MBPP - Missouri Basin Power Project
 CN - Central Nebraska Public Power and Irrigation, HQ at Holdrege
 TRI-STATE - Tri-State G & T Association, Inc. HQ at Denver, Colo.

Notes:
 ▨ Facilities west of East-West Transmission Tie.



PREPARED BY
R.W. BECK AND ASSOCIATES
 ENGINEERS AND CONSULTANTS
 COLUMBUS, NEBRASKA

D.2. Electric Generation--Nuclear

The single largest source of electricity in Nebraska is nuclear generation. During 1982, 50% of the electricity produced came from this source. Nebraska's nuclear generated electricity comes from two sources: Cooper Nuclear Station near Brownville, Nebraska, operated by NPPD with a rated capacity of 778 megawatts and the Fort Calhoun Station near Omaha with a rated capacity of 457 megawatts.

During 1982, coal was used to produce 43% of the total electricity generated in Nebraska.

The state of Nebraska has two major electric utilities. They are the Omaha Public Power District which serves 13 counties in southeastern Nebraska and the Nebraska Public Power District which supplies electricity to most of the rest of the state. In addition, Nebraska receives significant amounts of electricity from two sources outside the state. They are the Western Area Power Administration (Western) which is a 15-state federal power marketing authority, and Tri State Generation and Transmission is a cooperative serving Colorado, Wyoming and Nebraska which supplies power wholesale to most of the rural public power districts in western Nebraska. Western has its headquarters in Golden, Colorado, but Nebraska is served by two regional offices located in Loveland, Colorado and Billings, Montana. Tri State is headquartered in Thornton, Colorado.

In addition, Nebraska is interconnected by agreement with five other states and portions of two others through the Midcontinent Area Power Pool (MAPP). MAPP is a consortium of the utilities in the area who buy and sell power among themselves as needed..

E. Natural Gas

Nebraska is supplied in large part by two major natural gas pipelines. They are Northern Natural Gas and K-N Energy (formerly Kansas Nebraska Natural Gas). There are, however, several other large natural gas pipeline companies that supply a minimal part of natural gas to the state. All these sales are referred to as the wholesale market.

At the retail level the following companies distribute most of Nebraska's natural gas. Minnegasco headquartered in Minneapolis, serves 57 communities in the state. K-N Energy, headquartered in Lakewood, CO, not only serves as a pipeline company but also retails in 192 cities and towns. Peoples Natural Gas, a subsidiary of Internorth, headquartered in Omaha, retails in 42 communities in eastern and southeastern Nebraska. Northwestern Public Service Company, headquartered in Grand Island, retails in three Nebraska communities. The final major retailer of natural gas in Nebraska is the Metropolitan Utilities District, a public district which

retails in Omaha and in four surrounding communities. There are four other small companies that retail in 21 other towns:

- Gas Service Company in Kansas City, Missouri serves 2 towns
- Natural Gas Distributing Company in Ogallala serves 13 towns
- Iowa Electric Light and Power Company in Atlantic, Iowa serves 5 towns
- Iowa Public Service in Sioux City, Iowa serves 3 towns

In addition, there are eight Nebraska municipal gas companies that serve their respective cities:

- Ponca
- Stromsburg
- Hastings
- Central City
- Alma
- Lyons
- Pender
- Nebraska City (also provides service to Dunbar, Syracuse and Unadilla)

Of all the energy used in Nebraska in 1982, natural gas accounted for just over 25% of the total. The residential sector was the single largest user of natural gas, accounting for just over 43% of the total natural gas consumed.

III. HOW THE ENERGY IS USED

A. The Residential Sector

The 1980 Census shows that there were 625,000 dwellings in the state, of which 510,000 were single family dwellings. The remaining 115,000 were multiple dwelling units. For single family dwellings, a typical home in 1977 had a floor area of 1,300 square feet. New single family dwellings constructed for 1979-1981 had an average floor area of 1,500 square feet. Of these dwellings approximately 60% were constructed prior to 1960 and can be considered to have been constructed below current energy standards. Because of market demand and state adoption of minimal energy standards, most new homes are insulated and more energy efficient than older housing. A majority of homes are air conditioned, and there is a trend toward central units or whole-house conditioning. Most new homes are being built with central units.

Energy use in the residential sector can be divided into four major categories: space heating, water heating, space cooling, and other appliance use. Of these space heating accounts for about 60% of the home energy bill. Currently, approximately 70% of single family dwellings are heated by natural gas, 10% by electricity, and 20% by propane or heating oil. For 1979-81, 66% of new homes included gas heat, 33% electric heat, and 1% other. Energy required for space heating is projected to remain constant or decrease slightly in the future with the construction of more and larger homes being offset by better insulation in new homes, more efficient

furnaces, and weatherization of older homes. Heating requirements in Nebraska vary from year to year because of variations in weather. It is assumed that heating will be used whenever the outside temperature falls below 65 degrees Fahrenheit. Heating degree days, defined as the difference between a day's average temperature (if below 65 degrees) and 65 degrees Fahrenheit, is the measure used to record and predict heating requirements. A seasonal total can be obtained by summing over all such days. The seasonal normal for Nebraska is 6,326 heating degree days. Data for the recent past are presented in the following table.

Heating Degree Days

Heating Season	Degree Days	Deviation From Normal
1973-74	6,195	- 2.07%
1974-75	6,678	+ 5.56%
1975-76	5,887	- 6.94%
1976-77	6,331	+ 0.08%
1977-78	7,175	+13.42%
1978-79	7,453	+17.82%
1979-80	6,390	+ 1.01%
1980-81	5,565	-12.03%
1981-82	6,854	+ 8.35%
1982-83*	5,274	- 5.95%

* Data for the 1982-83 season is through March 27.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

It should be noted that three very atypical seasons have occurred in the past ten years. Heating degree days have exceeded 7,000 only four times in the past 50 years and two of them occurred back to back in the 1977-78 and 1978-79 seasons. The 1980-81 season was the second mildest for the same time period.

Electric utility statistics show that a typical Nebraska residence consumed about 9,600 kilowatt hours (kWh) in 1982. Consumption is projected to increase at a rate of about 1.5% a year through 1990 by the Nebraska Energy Office.

B. The Agricultural Sector

In 1982, Nebraska had 65,000 farms, down from 71,000 farms a decade earlier. The total farm acreage was 47,700,000 acres, or about 95 percent of the total area of the state. For the period 1979-1982 an average of 19,000,000 acres was planted to crops, about 4,000,000 acres were pasture or unplanted cropland, 23,000,000 acres rangeland, and the remaining 1,700,000 acres were in woodland and other uses. Four major agricultural uses for energy are:

field operations (primarily planting, tilling, and harvesting) irrigation, grain drying, and livestock operations.

The first three uses are dependent upon acreage and yields which in turn are affected by economic and weather conditions. For 1983 the acreage set-aside and diversion programs (including the Payment In Kind Program or PIK) will have a major impact on corn, sorghum, and wheat acreages. The following table presents 1981 and 1982 planted acreages and anticipated plantings for 1983 for major Nebraska crops.

Planted Area by Crop Type
('000 acres)

Crop	1981	1982	1983	1983 *
Corn	7,400	7,400	6,200	5,000
Oats	550	520	480	
Barley	30	28	60	
Sorghum (Milo)	2,300	1,860	1,450	1,300
Soybeans	2,150	2,350	2,100	
Dry Edible Beans	240	225	190	
Sugar Beets	80	52	NA	
All Hay	3,650	3,800	3,900	
Wheat	3,050	3,100	2,850	2,200
Rye	75	75	80	
Total	19,525	19,410	17,310	

Source: Nebraska Agri-Facts for 1981, 1982, and 1983 (February planting intentions). Released March 2, 1983.

* Nebraska Energy Office estimates taking farm programs into account.

B.1. Energy for Field Operations
(Planting, Tilling, Harvesting)

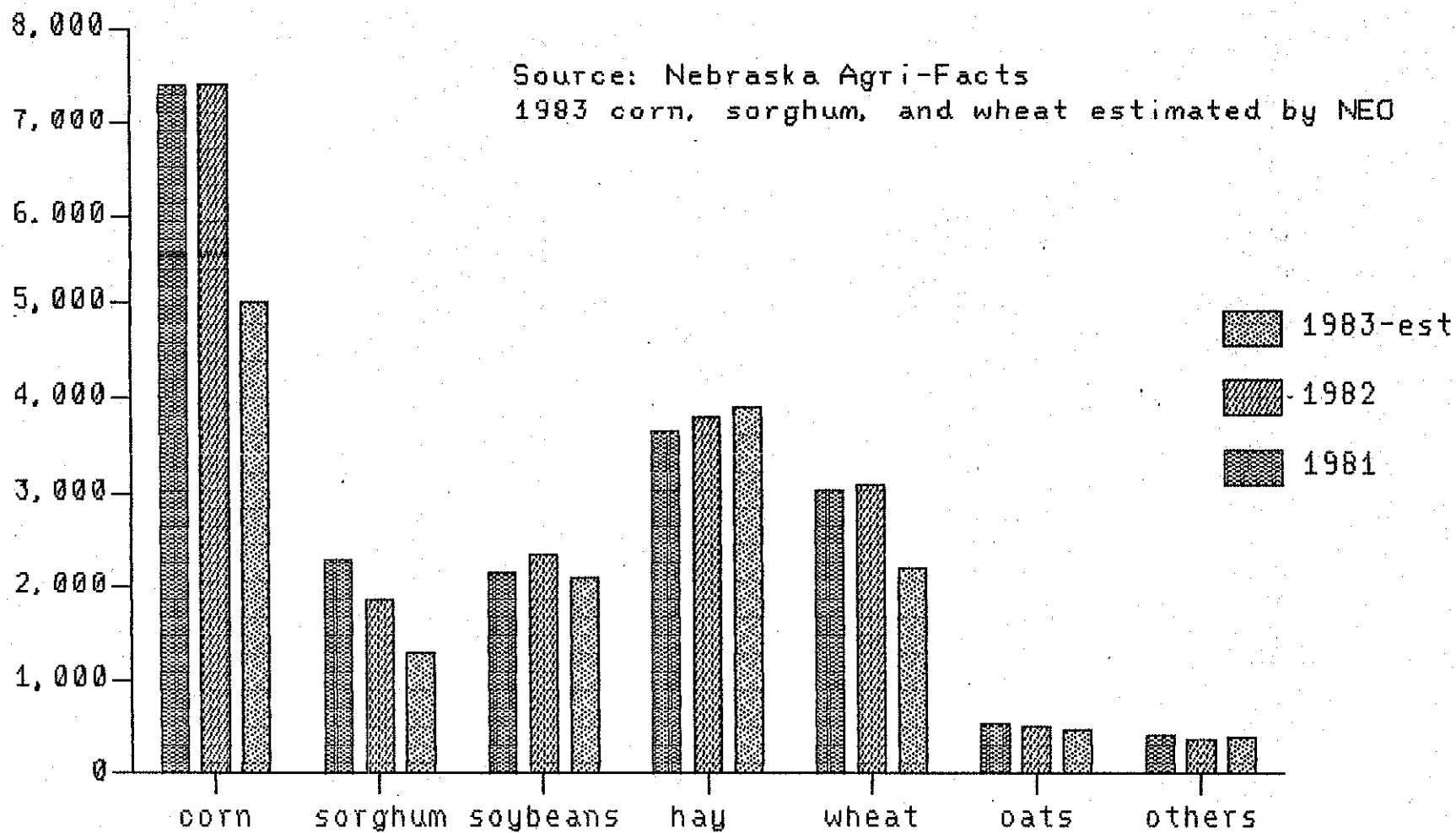
Energy Used *

Fuel	1981	1982	1983 (est.)
Diesel - million gallons	60 (8.3)	58 (8.0)	49 (6.8)
Gasoline - million gallons	18 (2.2)	20 (2.5)	15 (1.9)
Total - (trillion Btu)	(10.5)	(10.5)	(8.7)

* Trillion Btu equivalent given in parentheses.

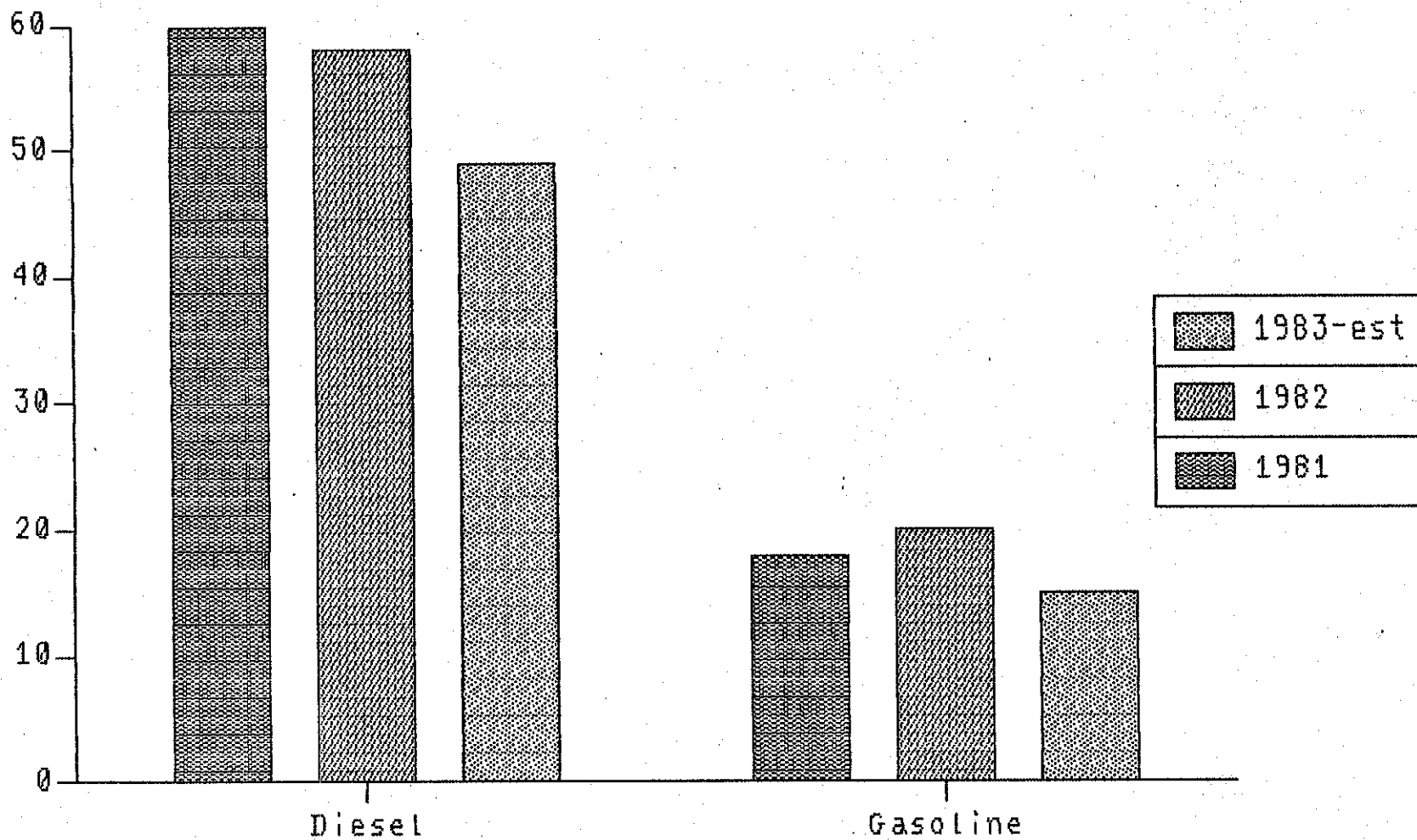
Although reports on the government programs indicate that feed grain (corn and sorghum) acreage will be down about 40% and wheat about 33%, energy requirements will not fall as much. First, this only accounts for about 20-22% of total acreage and second, a cover crop will be planted on much of the set-aside acreage.

Planted Area ('000 acres)



Source: Nebraska Agri-Facts
 1983 corn, sorghum, and wheat estimated by NEO

Energy for Field Operations (million gallons)



- 24 -

Nebraska Energy Office
May 27, 1983

B.2. Energy for Irrigation

In 1982, about 7.5 million acres were irrigated in Nebraska. Some 71,000 registered irrigation wells served approximately 90% of this need. The remaining 10% was irrigated from rivers, streams, or reservoirs.

The following table shows 1981-1982 energy usage by fuel type:

Energy for Irrigation		
Energy Used *		
Fuel	1981	1982
Diesel - million gallons	81 (11.2)	72 (10.0)
Electric - million kWh	800 (2.7)	800 (2.7)
Gasoline - million gallons	2 (0.2)	2 (0.2)
Propane - million gallons	26 (2.5)	39 (3.7)
Natural Gas - mcf**	4284 (4.3)	4290 (4.3)
Total - (trillion Btu)	(20.9)	(20.9)

* Trillion Btu equivalent given in parentheses.

** 1 mcf = 1000 cubic feet of natural gas.

Assuming similar weather conditions for 1983 as for 1981 and 1982, and an approximate proportionate decrease in irrigation requirements to total acreage, a reduction of 20-25% in energy requirements is projected by the Nebraska Energy Office. If the weather is hotter and dryer than the past two years it is obvious that less of a decrease would occur.

Corn and grain sorghum are the two grains requiring the most energy for drying. Small grains, soybeans, and others require rather insignificant amounts.

Energy for Irrigation (Trillion Btu)



The following table shows 1981-1982 energy requirements for drying by fuel type:

B.3. Energy for Grain Drying

Energy Used *

Fuel	1981	1982
Natural Gas - mcf	6283 (6.2)	6070 (6.0)
Electricity - million kWh	332 (1.1)	318 (1.1)
Propane - million gallons	36 (3.4)	45 (4.3)
Total - (trillion Btu)	(10.7)	(11.4)

* Trillion Btu equivalent given in parentheses.

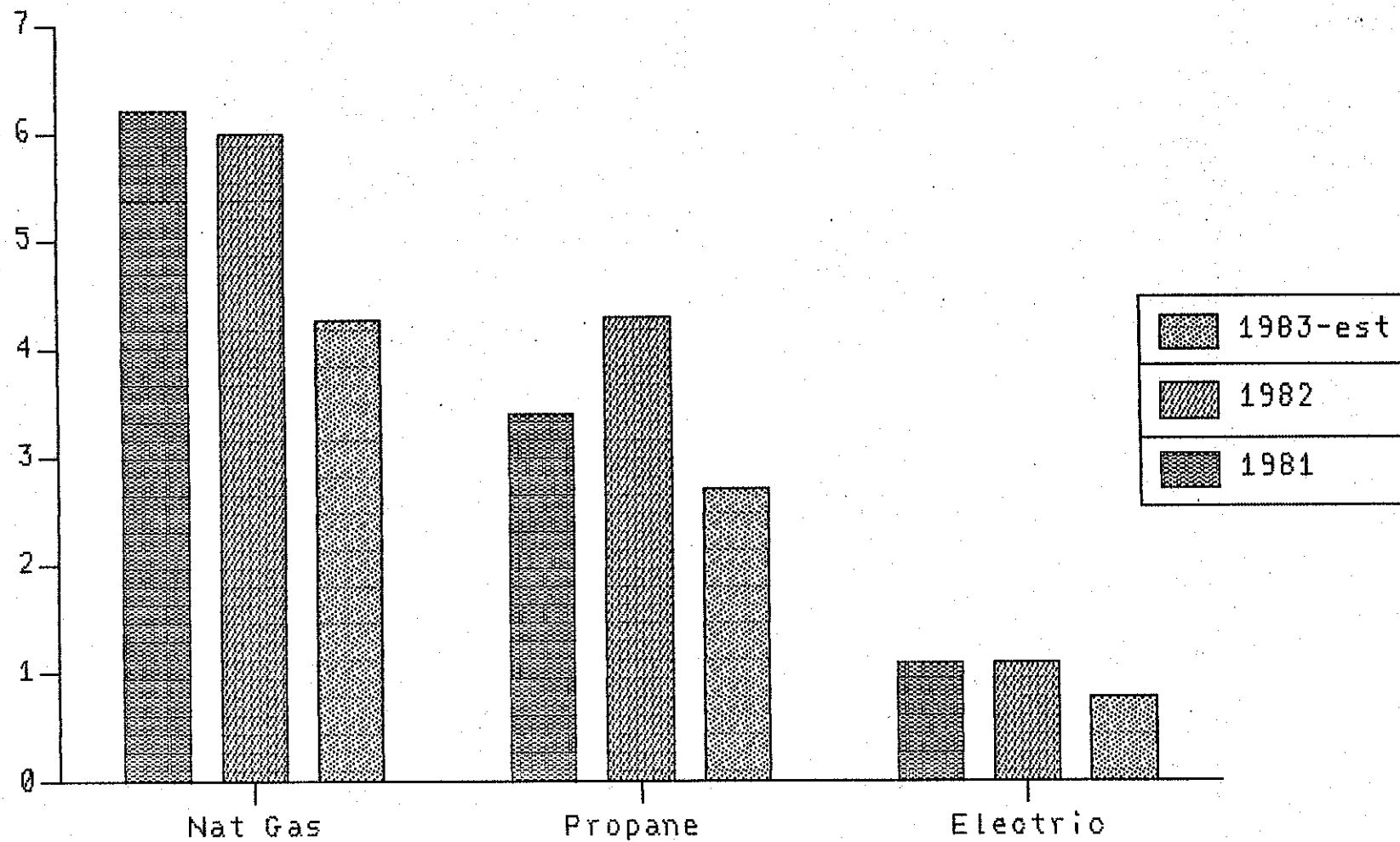
Assuming yields similar to those attained in 1981 and 1982 the Nebraska Energy Office expects energy requirements for grain drying to decrease approximately 30%. This is more than the proportionate decrease in total acreage but takes into account that corn and sorghum are the two primary grains involved in drying.

Again, fuel needs depend upon the weather to the extent that if crops dry well in the field, fuel needs are less than otherwise.

B.4. Other Agricultural Energy Use

Other agricultural uses for energy include livestock operations, lighting in farm buildings, and other farm machines. This usage for 1981 and 1982 follows:

Energy for Grain Drying (Trillion Btu)



Other Agricultural Energy Use

Energy Used *

Fuel	1981	1982
Electricity - million kWh	155 (0.5)	146 (0.5)
Propane - million gallons	2 (0.2)	3 (0.3)
Diesel - million gallons	25 (3.5)	25 (3.5)
Gasoline - million gallons	12 (1.5)	15 (1.9)
Total - (trillion Btu)	(5.7)	(6.2)

* Trillion Btu equivalent given in parentheses.

The Nebraska Energy Office projects that requirements for 1983 are expected to remain near the levels of 1981 and 1982.

Thus, estimated total energy requirements by agriculture for 1983 are:

B.5. Agriculture

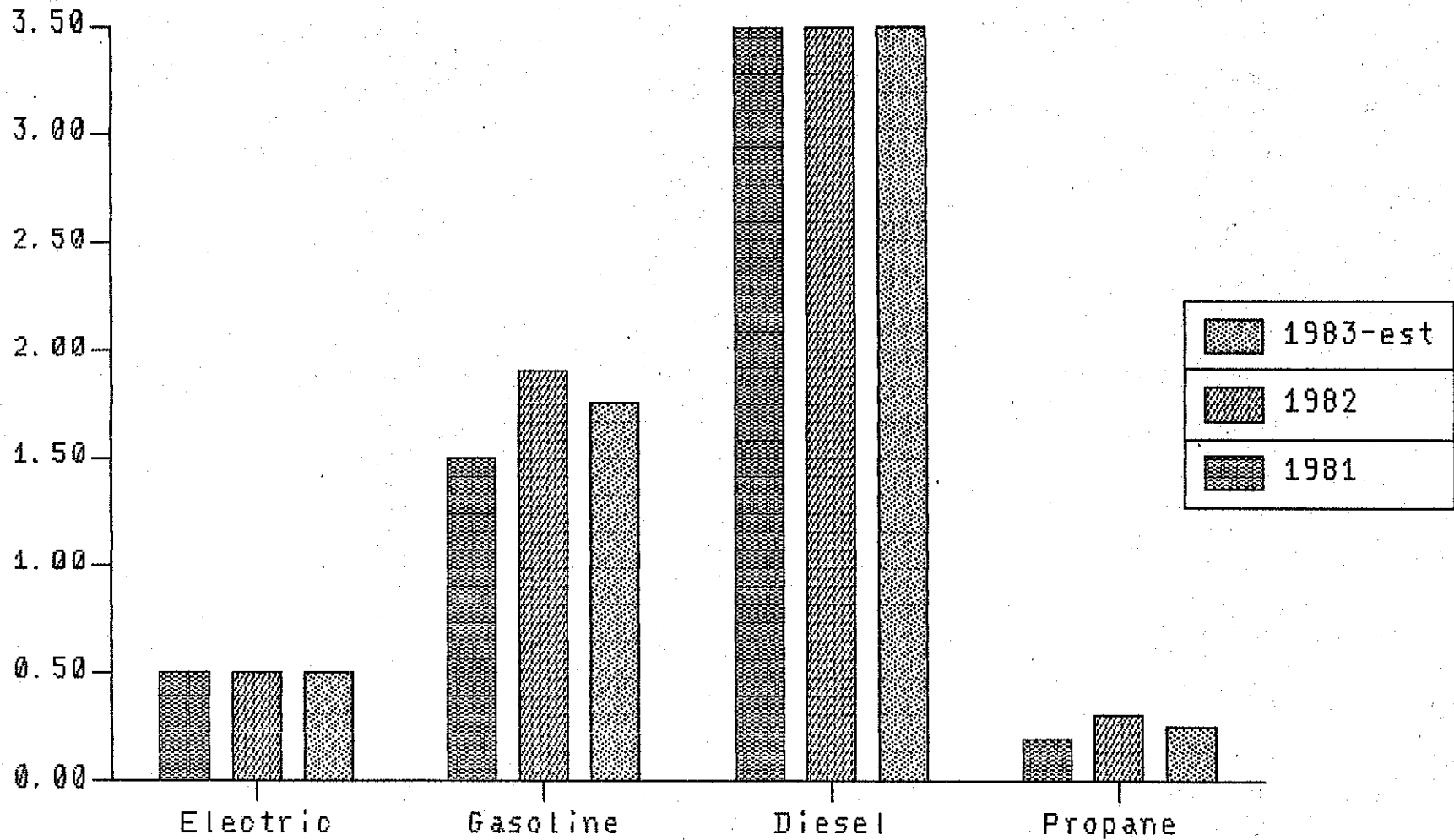
Estimated Energy Needs in 1983*

Fuel	Amount
Diesel - million gallons	128-133 (17.7-18.5)
Gasoline - million gallons	28-30 (3.5-3.7)
Electricity - million kWh	960-1030 (3.2-3.5)
Propane - million gallons	53-57 (5.0-5.4)
Natural Gas - mcf	7250-7800 (7.2-7.8)
Total - (trillion Btu)	(36.6-38.9)

* Trillion Btu equivalent given in parentheses.

This compares with usage of 48 trillion Btu in 1981 and 49 trillion Btu in 1982.

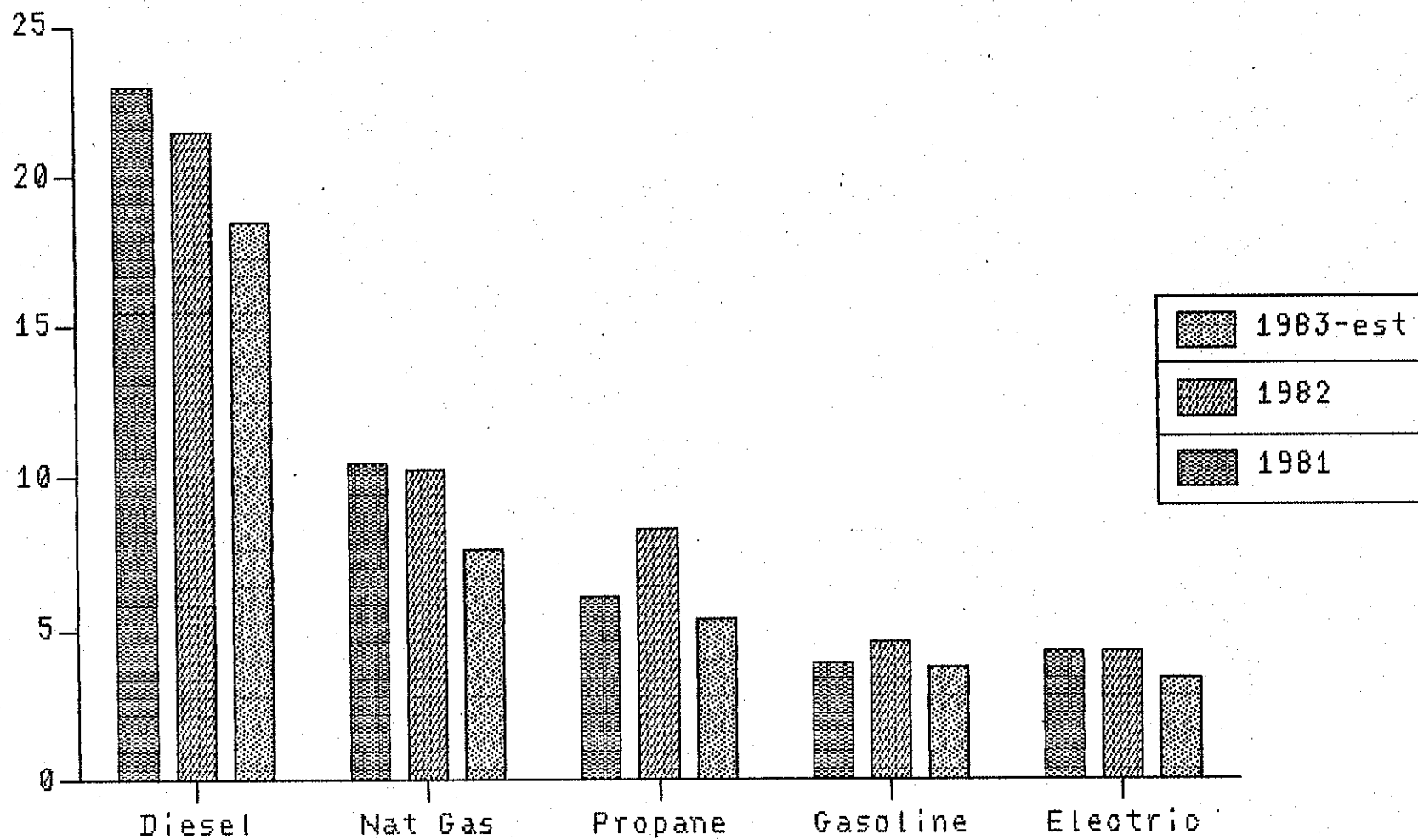
Other Agricultural Energy Use (Trillion Btu)



- 30 -

Nebraska Energy Office
May 27, 1983

Total Agriculture Energy Use (Trillion Btu)



C. The Commercial Sector

Nebraska has about 35,000 commercial enterprises, employing approximately 70% of the total labor force. The commercial sector of Nebraska's economy includes 163,000 persons employed in wholesale and retail trade, or about one of every four of the labor force. This is more than the total employment in agriculture. Government, including public schools, colleges, and universities, is included as part of the commercial sector.

Activity in the commercial sector takes place in a variety of settings, such as stores, offices, hotels, motels, theaters, restaurants, and cafes. The needs for energy vary widely among these facilities, but they all have common requirements for:

- space heating and cooling
- lighting
- other special requirements (water heating, office equipment, cooking, elevators, computers, ventilating equipment, and communications systems).

Space heating accounts for about 54% of the total energy budget for the commercial sector, space cooling, 12%; water heating, 4%; and other uses including the special requirements listed above, 30%.

The primary fuels used in the commercial sector are natural gas, electricity, petroleum distillates (diesel, heating oil, kerosene, and other similar fuels), and propane. Use by fuel type for the period 1978-1982 is presented in the following table:

Commercial Sector Use by Fuel Type *

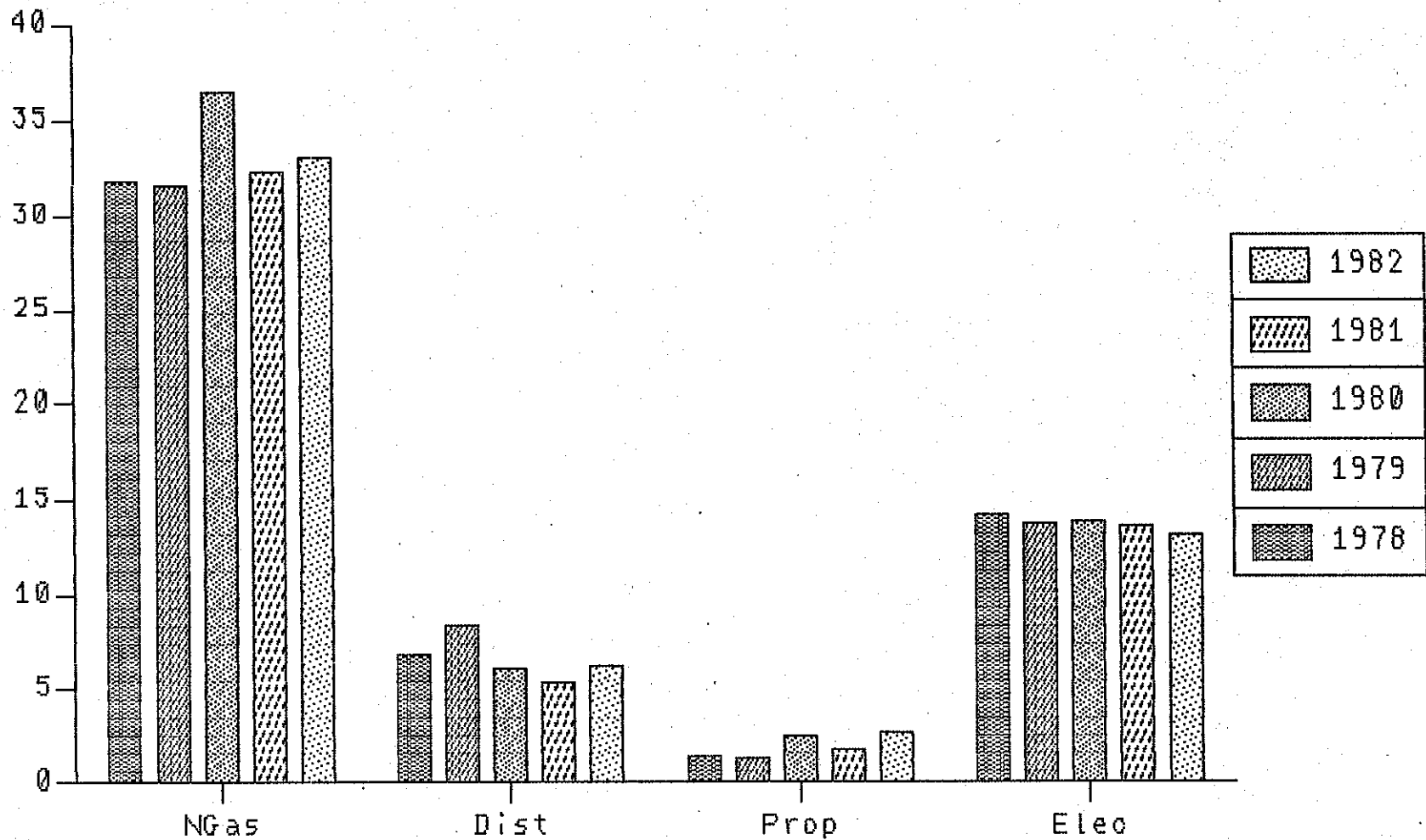
	1978	1979	1980	1981	1982
Natural Gas bcf**	32.0(31.8)	31.8(31.6)	36.6(36.4)	32.5(32.3)	33.2(33.0)
Distillates million gallons	49.7 (6.9)	60.6 (8.4)	44.0 (6.1)	38.9 (5.4)	45.4 (6.3)
Propane million gallons	14.7 (1.4)	13.6 (1.3)	26.2 (2.5)	17.8 (1.7)	28.3 (2.7)
Electricity million kWh	<u>4190(14.3)</u>	<u>4014(13.7)</u>	<u>4073(13.9)</u>	<u>3984(13.6)</u>	<u>3868(13.2)</u>
Total (trillion Btu)	(54.4)	(55.0)	(58.9)	(53.0)	(55.2)

* Trillion Btu equivalent given in parentheses.

** 1 bcf = 1 billion cubic feet of natural gas.

Source: Nebraska Energy Office Annual Reports

Commercial Sector Use by Fuel Type Trillion Btu



D. The Industrial Sector

Nebraska has about 2,400 industrial firms in the state. Many of these are included in the commercial sector for energy data purposes since utilities base their classifications on the amount of power and energy required by a customer. For the same reasons, commercial enterprises may be included in the industrial sector when compiling energy data. Meat packers require large quantities of steam in their processes, as well as large amounts of refrigeration for handling their products. Companies dealing with metals and metal processing require large amounts of electric energy in their machinery operations. From these two examples it is evident that an average or typical Nebraska industry probably does not exist. It is, however, possible to estimate the total energy requirements of this sector of the state's economy by establishing relationships between energy use and value added by industrial group. Value added is the difference between the value of a finished product and the total value of the materials used in it.

Major industries in the state by Standard Industrial code (SIC) are:

SIC 20	Food and Kindred Products
SIC 28	Chemicals and Allied Products
SIC 32	Stone, Clay, and Glass Products
SIC 33	Primary Metals
SIC 35	Machinery, Except Electrical
	Others

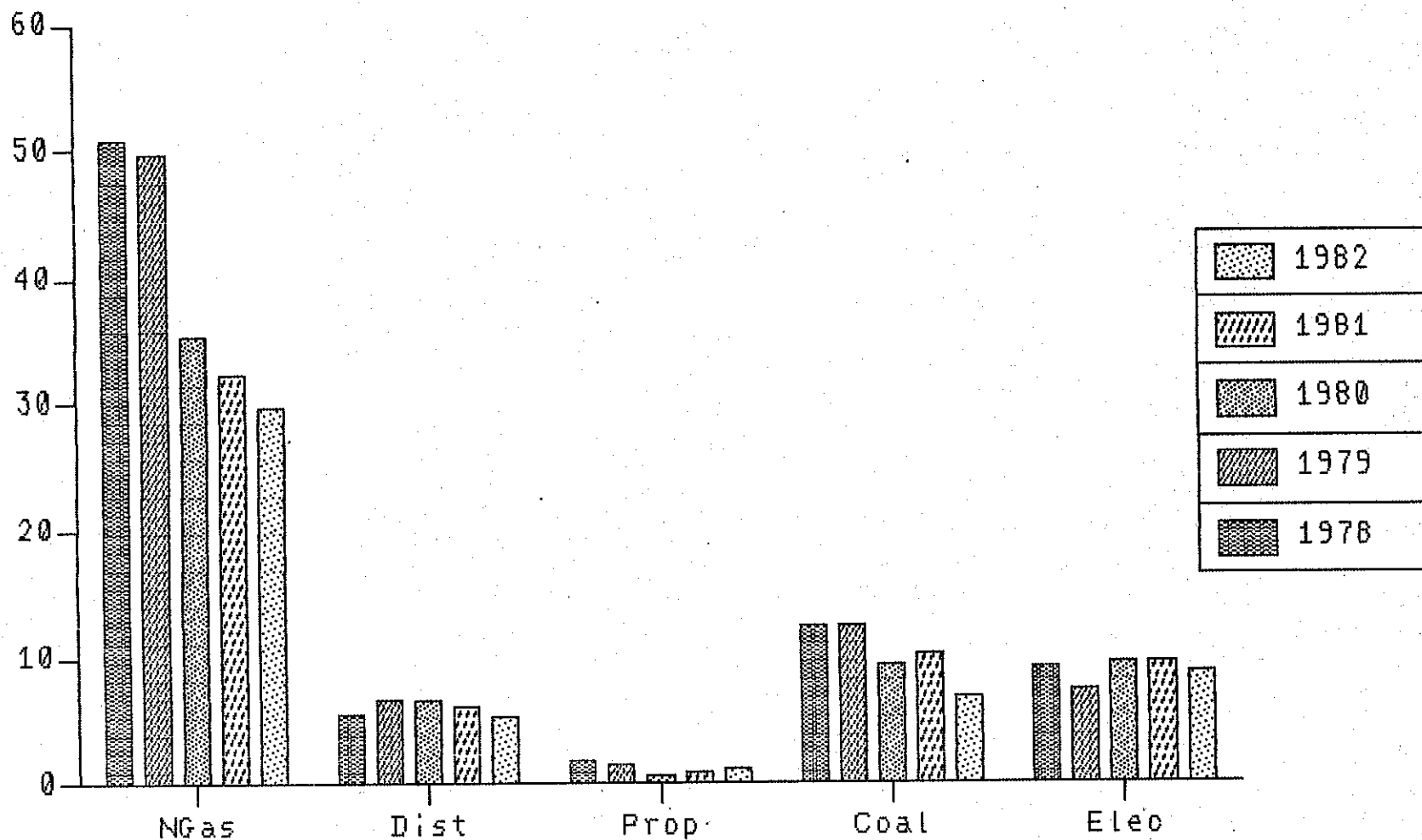
Fuels which provide nearly all of the energy requirements in the industrial sector are natural gas, electricity, petroleum distillates (diesel, heating oil, kerosene, and other similar fuels), propane, and coal. Use by fuel for the period 1978-1982 is presented in the following table:

Industrial Sector by Fuel Type Use *

	1978	1979	1980	1981	1982
Natural Gas bcf	51.2(50.9)	50.1(49.8)	35.5(35.3)	32.4(32.2)	30.0(29.8)
Distillates million gallons	39.7 (5.5)	48.3 (6.7)	47.6 (6.6)	43.3 (6.0)	38.9 (5.4)
Propane million gallons	19.9 (1.9)	17.2 (1.6)	7.5 (0.7)	9.5 (0.9)	12.5 (1.2)
Coal million short tons	.554(12.5)	.554(12.5)	.417 (9.4)	.457(10.3)	.306 (6.9)
Electricity million kWh	<u>2666 (9.1)</u>	<u>2768 (9.4)</u>	<u>2783 (9.5)</u>	<u>2783 (9.5)</u>	<u>2607(8.9)</u>
Total (trillion Btu)	(79.9)	(80.0)	(61.5)	(58.9)	(52.2)

* Trillion Btu equivalent given in parentheses.

Industrial Sector Use by Fuel Type Trillion Btu



Nebraska Energy Office
May 27, 1983

The marked decline in natural gas use between 1979 and 1980 was the result of several factors. One of these was the Power Plant and Industrial Fuel Act of 1978 which prohibited, with some exemptions, installation of gas-burning power plants and boilers as a response to the then-apparent shortage of natural gas supplies in the eastern one-third of the United States.

Secondly, price increases following the partial deregulation of gas under the Natural Gas Policy Act of 1978 caused industrial customers to look to other energy sources for space heating and process steam.

Finally, the economic recession has had a dampening effect on manufacturing operations, resulting in reduced consumption of natural gas in the industrial sector.

If economic conditions improve as expected, energy use in the industrial sector should show some increase.

E. The Transportation Sector

Practically all of the energy for transportation comes from oil, gasoline, and diesel fuels. Because motor fuels are subject to tax, the State Department of Revenue records consumption. Total motor gasoline consumption in Nebraska for 1982 was 697,227,000 gallons. In addition 89,878,000 gallons of super unleaded with ethanol (gasohol) were consumed. Some 146,434,000 gallons of other motor vehicle fuels (diesel and propane, for example) were consumed during 1982.

Total gasoline and super unleaded with ethanol available for sale in Nebraska was down slightly in 1982 from 1981 levels. This reflects a leveling off of the downward trend in consumption evident since 1978 when usage peaked. Decreases in consumption of gasoline are being made up by increases in super unleaded with ethanol, of which was up 288 percent in 1982 over 1981 and now represents about 10% of motor fuels consumption of Nebraska.

Gasoline and Super Unleaded with Ethanol (Gasohol) Availability
1978 through 1982
(1,000 Gallons)

Year	Gasoline	Super Unleaded with Ethanol (Gasohol)	Total	Change From Previous Year
1978	951,226	*	951,226	---
1979	903,431	6,890	910,321	-4.3%
1980	808,877	30,138	838,015	-7.8%
1981	761,277	31,181	792,458	-5.5%
1982	696,863	89,841	786,705	-0.7%

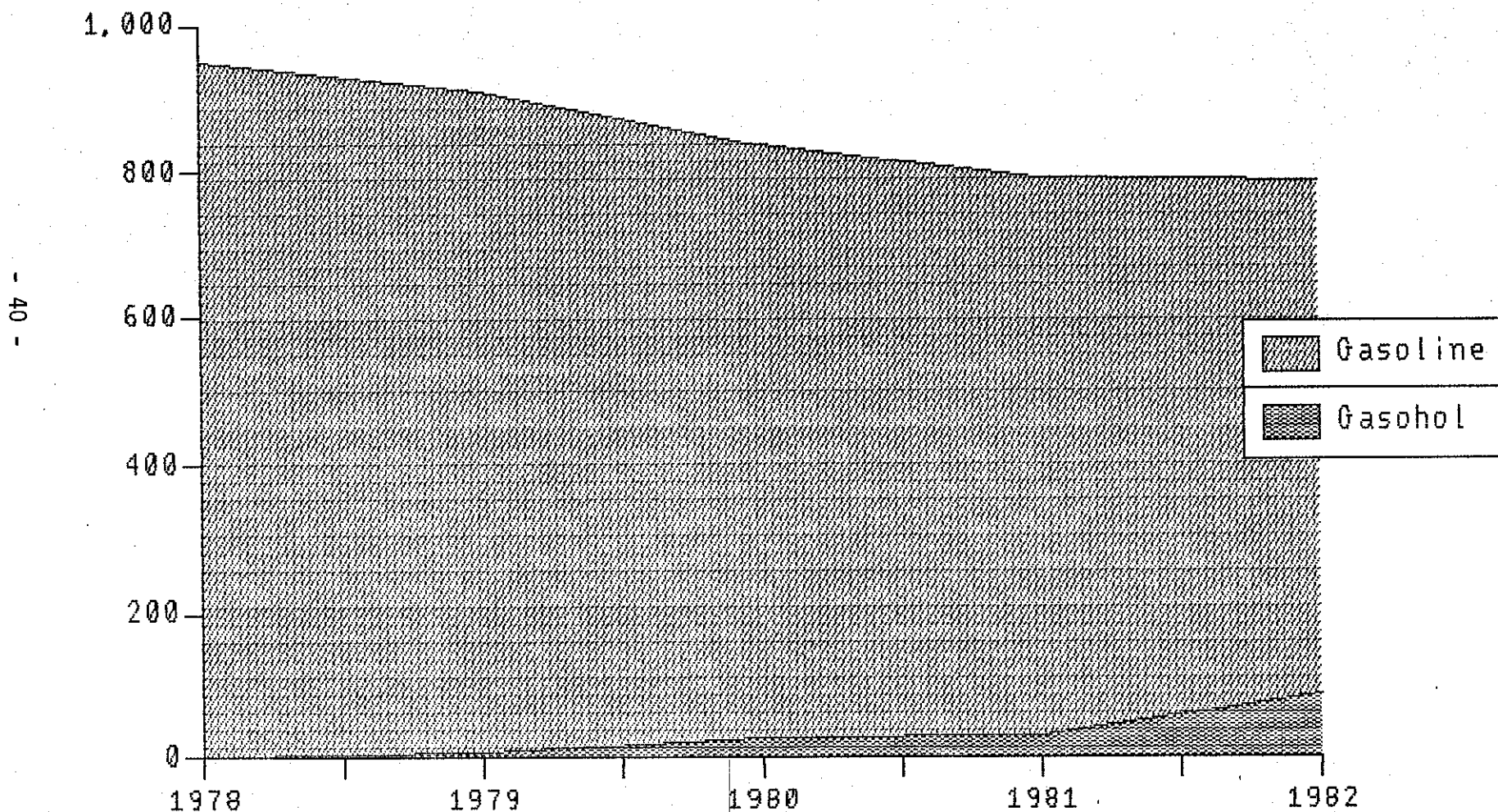
* Gasohol data not collected until 1979.

Source: Nebraska Energy News, March 1, 1983.

Mileage driven peaked in 1978, then decreased in 1979-80. From 1981 mileage has again been gradually increasing. Fuel use has continued to decrease since improved efficiency in miles per gallon has more than offset any mileage increase. Due to decreasing gasoline prices travel may be up in 1983, leading to minor increases in motor fuel usage over 1982.

The use of aviation fuels has decreased in Nebraska from 41,099,000 gallons in 1980 to 31,299,000 gallons in 1982. This decrease has come about primarily because of the decrease in number of commercial flights in and out of Nebraska.

Gasoline and Super Unleaded with Ethanol (Gasohol) Million Gallons



Nebraska Energy Office
May 27, 1983

Utilization of Energy in Nebraska

Source	1978	1979	1980	1981	1982 (Prelim)
Natural gas (billion cubic feet)					
Residential	48.2	53.5	60.0	61.5	60.8
Commercial	32.0	31.8	36.6	32.5	33.2
Industrial	51.2	50.1	35.5	32.4	30.0
Other (agric.)	8.7	11.7	10.4	11.2	9.7
Electric Utility	12.8	14.0	11.7	5.2	1.3
Total Natural Gas	152.9	161.1	154.2	142.8	135.0
Middle Distillates (million gallons)					
Aviation Fuel	46.0	42.4	41.1	34.3	30.3
No. 1 Fuel Oils	36.8	42.6	30.7	21.5	19.5
No. 2 Heating Oils	191.0	201.9	177.2	156.8	142.0
Diesel Fuel	309.9	316.2	270.4	236.5	214.3
Total Distillates	583.7	603.1	519.4	449.1	406.1
Propane (LPGas) (million gallons)					
Residential/Commercial	141.5	121.9	84.3	67.6	89.4
Internal Combustion	17.9	15.4	35.2	28.1	37.2
Industrial	19.9	17.2	7.5	9.5	12.5
Other	50.3	43.4	33.0	23.0	30.4
Total Propane	229.6	197.9	160.0	128.2	169.5
Gasoline (million gallons)					
Agriculture	24.0	35.2	30.4	31.0	34.0
Transportation	927.2	868.1	808.3	761.5	754.5
Total Gasoline	951.2	903.4	839.0	792.5	788.5
Coal (million short tons)					
Commercial	0.01	0.01	--	0.016	0.019
Industrial	0.55	0.55	0.42	0.305	0.305
Electric Utility	2.90	3.46	5.05	4.995	5.068
Total Coal	3.46	4.02	5.47	5.316	5.392
Electricity Production (GWH = million kwh)					
Hydrostations	1,187	1,246	1,335	1,197	1,096
Nuclear	7,725	8,658	5,783	5,990	8,980
Coal	4,664	6,027	8,123	8,481	7,705
Natural Gas	994	1,088	947	352	108
Petroleum	631	398	126	46	72
Total Production	15,201	17,417	16,314	16,065	17,960

Electric Sales to Ultimate Consumers by Sector (GWH = million kWh)

Electricity Usage by Sector
(million kWh)

	1978	1979	1980	1981	1982
Residential	5,332	5,274	5,538	5,246	5,679
Commercial	4,190	4,014	4,073	3,984	3,868
Industrial	2,666	2,768	2,783	2,783	2,607
Agricultural	1,151	1,301	1,314	1,318	1,230
	<u>13,339</u>	<u>13,357</u>	<u>13,708</u>	<u>13,331</u>	<u>13,384</u>
Annual Energy (trillion = 10^{12} Btu)	560.3	571.8	540.1	511.6	533.8

Note: Total energy consumption represents all fuel types.

Source: Nebraska Energy Office Annual Report, 1982.

III. SUMMARY

Total energy use in Nebraska increased each year from 1960 through 1978 except for 1967. The rate of increase during the 1970's was approximately 3% per year, down from the nearly 6% annual increase from 1960 to 1970. After peaking in 1979, energy use declined about 5% in both 1980 and 1981 followed by a 4% increase for 1982. Nebraska Energy Office estimates indicate a continuing increase in demand through 1990, however, at a more moderate 1.5% rate.

Conversion Table - Physical Unit to Btu

Fuel Type	Conversion Factor
Coal	22.56×10^6 Btu/short ton
Natural Gas	0.994×10^6 Btu/mcf
Gasoline	0.12495×10^6 Btu/gallon
Aviation Fuel	0.1334×10^6 Btu/gallon
Propane (LPGas)	0.0955×10^6 Btu/gallon
Other Petroleum	0.1387×10^6 Btu/gallon
Electricity	3413 Btu/kWh

Source: Nebraska Energy Office Annual Report, 1982.