Help Create a New State Energy Plan

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Why does Nebraska need an energy plan? The first state energy plan was compiled in the early 1990s, and the world and how we use energy has changed considerably since then.

Energy is the foundation of our productivity. Business, industry and agricultural production rely on energy. Without it, the economy of Nebraska would grind to a halt.

Energy efficiency and emerging renewable energy resources are economic opportunities for the state. As a state, we need to agree on how best to maximize these opportunities. While we look for new opportunities, we cannot ignore the reality that we are dependent upon other states and nations for our energy needs.

With an updated state energy plan, Nebraska should be able to chart a course that maintains a balance between economic growth, environmental stewardship and energy security.

The Process

Nebraskans are encouraged to comment and offer suggestions on the state's future energy course. Opportunities to share thoughts and ideas are available both on line and at a series of meetings being held across the state.

The Schedule

Initial Comment Period

October 29 - December 1, 2008

Public Comment Sections

- **October 29**, 9:00-11:00 am in **Broken Bow**; Paddock Room, 1710 Cherokee Lane, Custer County Fairgrounds
- **October 30**, 9:00-11:00 am in **Scottsbluff**; University of Nebraska Panhandle Research Center, Bluestem Room
- **November 3, 1:00-4:00 pm CT**
  - ◊ **Chadron**, Chadron State College, Burkheiser Hall Room 109, 10th & Main St.
  - ◊ **Valentine**, Cherry County Coop Extension, Conference Room, 132 South Hall St. Suite #1
  - ◊ **Norfolk**, NECC, Maclay Building, Room 122, 801 E. Benjamin Ave.
- **November 5, 1:00-4:00 pm**
  - ◊ **McCook**, MCC, McMillen Hall, Room 208
  - ◊ **Hastings**, Hastings Public Library, 2nd Floor, 517 W. 4th St.
- **November 6**, 9:00-11:00 am at **Mahoney State Park near Ashland**, Riverview Lodge
- **November 7**, 9:00-11:00 am in **Nebraska City** at Steinhart Lodge, 125 Steinhart Park Rd

Compilation of Comments

December 15, 2008

2009 Nebraska Energy Plan

January 1, 2009

Comments can be made online at
www.neo.ne.gov/energyplan.htm

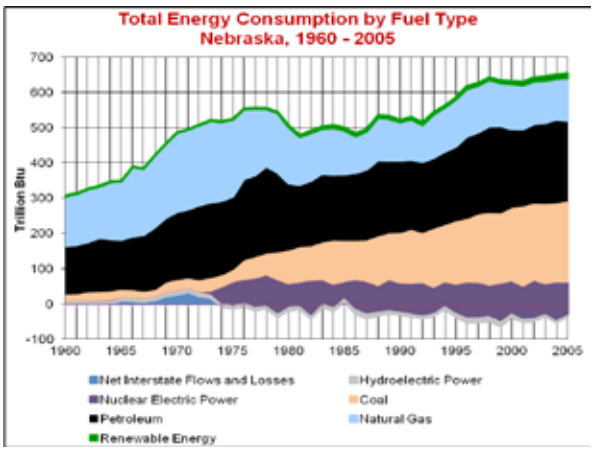
Overview of Nebraska Energy Use

BACKGROUND

For more than four decades, Nebraska's energy needs have been met by natural gas, petroleum products, coal, and renewable energy. Motor gasoline and distillate fuel are the principal petroleum products. Since the mid-1970s, nuclear electric power has also played a role.

From 1960 to 2005, Nebraska's total energy consumption more than doubled from 308.3 trillion Btus to 654.9 trillion Btus. This increase in consumption is reflected primarily in the electric power sector in which consumption increased six-fold from 50.2 trillion Btus to 331.0 trillion Btus. Energy consumption was 373.4 million Btus per person in 2005. The transportation sector's energy consumption is significantly affected by miles traveled and the number of vehicles. The industrial sector's consumption rises and falls with economic cycles. Aside from doubling natural gas consumption in the mid-1960s possibly as a result of the relatively low price, the commercial sector's consumption has been constant. Despite small increases in population, the residential sector's energy consumption has been constant over time with very little growth.

According to the Energy Information Administration, Nebraska had the 13th lowest energy consumption in the country with less than one percent of the nation's total consumption in 2005. Nebraska's energy needs were met by petroleum (33 percent), coal (33 percent), natural gas (17 percent), nuclear electric power (13 percent), and hydroelectric power and other renewable energy (three percent).

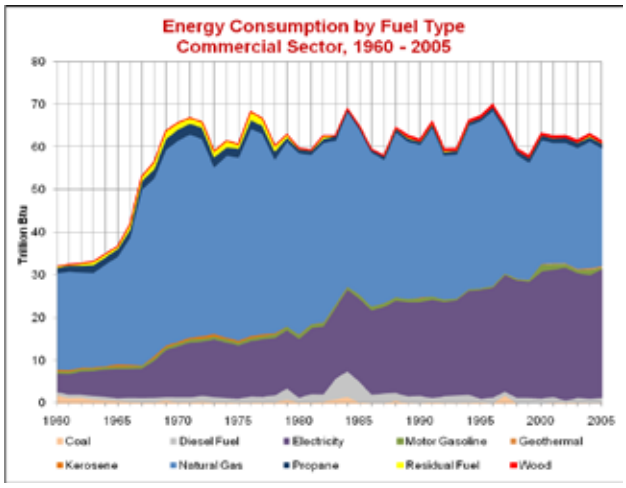


SECTORS

There are five sectors of energy consumption. They are commercial, electric power, industrial (which includes agricultural), residential and transportation.

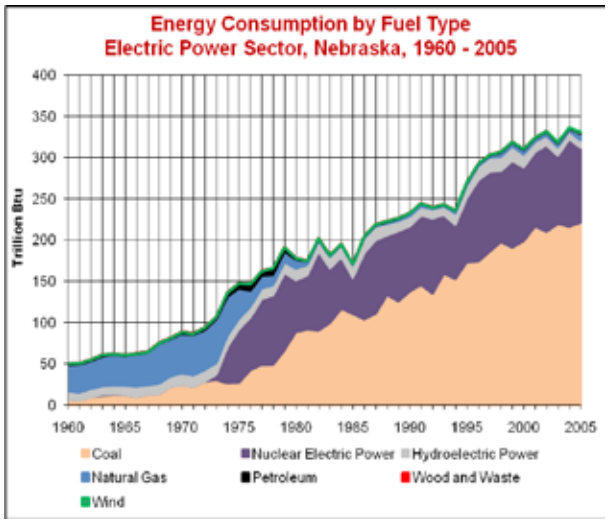
Commercial

The commercial sector consists of nonmanufacturing business establishments. Included are hotels, motels, restaurants, wholesale businesses, retail stores, laundries, and other service enterprises; health, social, and educational institutions; and federal, state, and local governments. Streetlights, pumps, bridges, and public services are also included. Fuel used in motor vehicles for commercial purposes is included in the transportation sector. Examples of common uses of energy in the commercial sector include space heating, water heating, refrigeration, air conditioning, and cooking. Electricity and natural gas have met almost all of the commercial sector's energy needs since 1960.



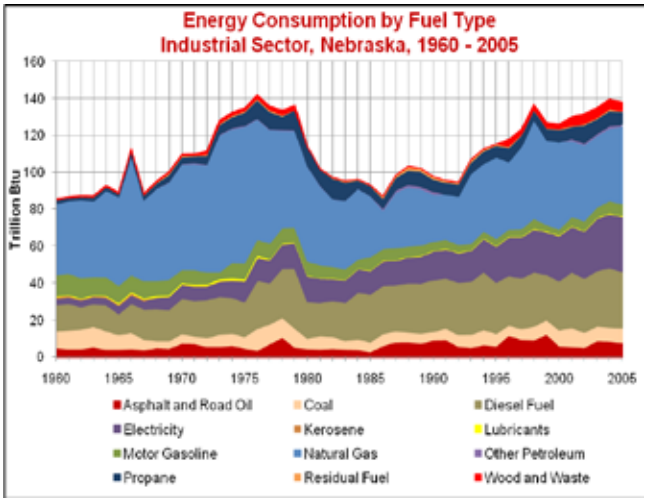
Electric Power

The electric power sector consists of facilities which generate electricity primarily for use by the public. Energy is used for the generation, distribution, and transmission of electric power. Trends in the electric power sector in Nebraska have remained generally constant over time: Natural gas, hydroelectric power, and coal were the principal fuels used by electric utilities from 1960 through the mid-1970s. Since then, coal and nuclear electric power have become the major players with hydroelectric power and renewable energy in minor roles.



Industrial

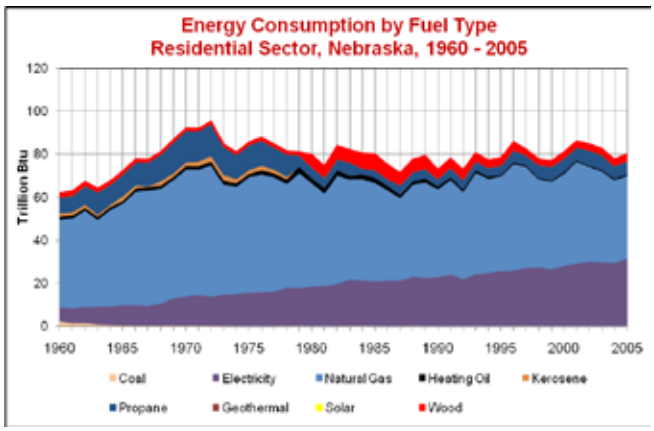
The industrial sector consists of manufacturing, construction, mining, agriculture, and forestry organizations. Energy used by this sector to transport products to market or inputs to the organizations is included in the transportation sector. The industrial sector relies on more diverse types of fuel than the other sectors. Natural gas, electricity, coal, and various petroleum products — gasoline, asphalt, road oil, propane, and diesel fuel — are the primary energy types utilized in this sector's operations.



Residential

The residential sector consists of private households. Energy is consumed primarily for space heating, water heating, air conditioning, refrigeration, cooking, clothes drying, and lighting. Fuel used for motor vehicles by household members is included in the transportation sector.

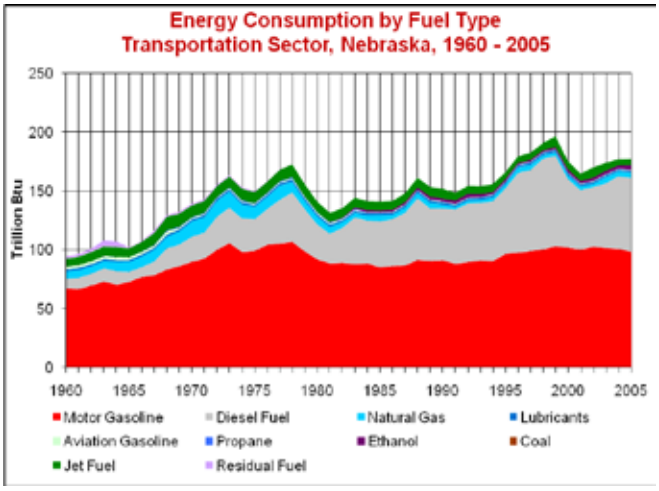
Since 1960, more than half of the residential sector's energy needs have been met by natural gas. A third of the energy consumed in the residential sector was electricity. Petroleum products and renewable energy comprise small portions. According to the Census Bureau, out of every ten Nebraska households, six or seven use natural gas for home heating, two use electricity, and one uses petroleum products.



Transportation

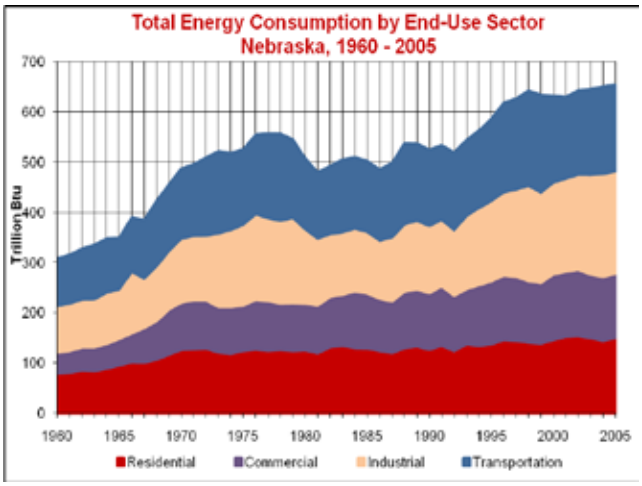
The transportation sector consists of private and public vehicles that move people and commodities. Included are automobiles, trucks, buses, motorcycles, railroads, aircraft, ships, barges, and natural gas pipelines. Natural gas use reflects the fuel needed to move natural gas through a pipeline to end users in the residential, commercial, industrial, and electric power sectors.

The transportation sector in Nebraska is almost exclusively dependent upon petroleum-based fuels. This level of dependency on petroleum has not essentially changed since 1960, when record-keeping began. Motor gasoline, diesel fuel, jet fuel, and lubricants made up the majority of the petroleum products consumed by the transportation sector. Natural gas and ethanol comprised the remaining small portion of energy needs.



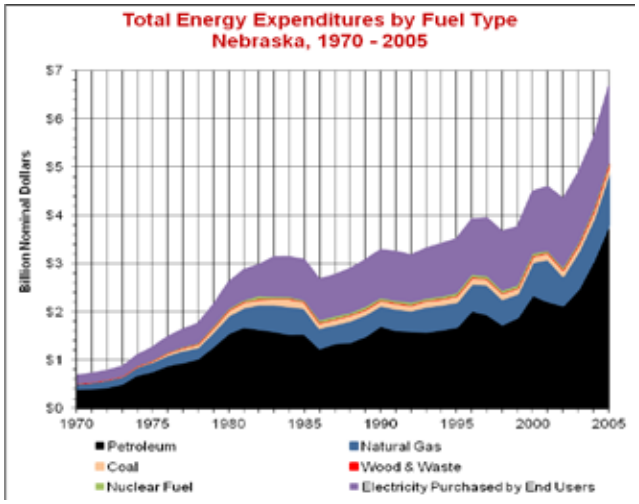
End-Use Sectors

The four end-use sectors have comprised relatively equal portions of Nebraska's total energy consumption since 1960. End-use sectors are the residential, commercial, industrial, and transportation sectors of the economy, which excludes energy used in the generation of electricity--the electric power sector's consumption. End-use energy consumption refers to the energy content of electricity and other fuels at the point of use by consumers.



Expenditures

Energy expenditures over the last 35 years have steadily increased in the state. Based on the latest federal figures, Nebraska's expenditures for energy reached $6.4 billion in 2005. Energy expenditures were $3,657 per person. Over half of Nebraska's energy expenditures have been for petroleum and petroleum products since 1970 with electric power and natural gas comprising the other major portion. Wood and waste make up the entire cost associated with renewable energy since there are no direct fuel costs for hydroelectric, geothermal, wind, photovoltaic, or solar thermal energy. The Energy Information Administration does not track the expenditures on ethanol.



GOAL

Promote the efficient, economic and environmentally responsible use of energy.

Agriculture

Agriculture is a major user of energy, and energy costs are a significant agricultural expense. In 2007, Nebraska consisted of 47,300 farms and ranches encompassing 45.6 million acres or about 93 percent of its total land area.

Direct energy consumption in the agricultural sector is in the form of diesel, gasoline, natural gas, propane, and electricity and accounts for 5-7 percent of farm expenditures. Diesel comprises over half of farm energy consumption. Gasoline comprises 16 percent, natural gas – 9 percent, propane – 9 percent, electricity – 13 percent, and other fuels – 2 percent. Indirect energy consumption is considered to be fertilizers and pesticides and accounts for 9-10 percent of farm expenditures. (year 2006)

After 24 years of stable electricity expenditures in Nebraska's agricultural sector, expenditures started increasing in the early 1970s and peaked in 2002 at $164.1 million. Since 1949, fertilizer expenditures have increased almost on an annual basis peaking in 2007 at $900 million. Fuel and oil expenditures were relatively stable throughout the 1950s and 1960s, peaking in 1981 at $416.7 million and then peaking again in 2007 at $580 million.

Along with ethanol and biodiesel, biomass and farm wastes can be used to produce renewable energy. Wind energy offers opportunities for integrated on-farm production and consumption. Solar-based energy systems offer potential power for livestock watering, battery charging, electric fencing, and lighting in more remote areas. Geothermal resources produce electrical or thermal energy to heat greenhouses and to dry produce.

Agriculture has the potential to become an increasingly important source of renewable energy and provide significant economic opportunities for farmers and ranchers. Renewable energy production stimulates the agricultural and rural economy, improves the environment, and enhances state energy security. The domestic energy supply could be expanded and our growing foreign oil dependence could be reduced with the development of new energy sources in the agricultural sector.

GOAL

As Nebraska's largest and most diverse industry, undertake special efforts to encourage energy efficiency and conservation in all aspects of the agricultural sector.

Building Energy Codes

Building energy codes in the United States are a result of the recurring energy crises the country has experienced since the early 1970s and the passage of federal legislation intended to alleviate future occurrences and impact. Adopting and enforcing building energy codes has an impact beyond the future building operating costs. It improves the quality of the state's building infrastructure, increases the investment and economic impact of new construction through local purchases of materials and labor, reduces the economic and environmental impact on the state's importation of fossil fuels used by the state's building stock and delays infrastructure improvements and construction of additional capacity.

BUILDING ENERGY CODES IN OTHER STATES

Forty states have adopted Commercial Building Energy Codes and thirty-eight have adopted Residential Building Energy Codes. Many of the remaining states have local code jurisdictions with codes that exceed state mandated minimum standards. Generally, states that have mandated building energy codes have adopted either a code developed and published by the International Codes Council (ICC) or a Standard developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). The advantages to states that adopt these national codes and standards include technical assistance regarding interpretation and enforcement, input from many national energy and building code experts and a consistent and orderly code update cycle and process.

NEBRASKA'S BACKGROUND

The Nebraska Building Energy Conservation Standard Act, passed in 1980, was the state's first Building Energy Code. The Code was updated in 1983 to the Model Energy Code (MEC) developed by the Council of American Building Officials in 1983. The Code remained unchanged until 1999 when the legislature adopted the 1998 International Energy Conservation Code (IECC) developed by the International Code Council (ICC) for buildings constructed in-whole or in-part with state funds. This was updated in 2003 to the 2000 IECC as part of the state construction industry's efforts to encourage the adoption of the building codes being developed on a national level by the ICC. In 2004, the Nebraska Legislature adopted the 2003 IECC as the Nebraska Energy Code for all new buildings constructed within the state and for substantial renovation projects.

The Energy Office is currently working on a U.S. Department of Energy-funded initiative that will evaluate the reasonableness and cost effectiveness of Nebraska adopting an advanced Commercial Building Energy Code that exceeds by 30% the requirements of the 2006 IECC and ASHRAE 90.1-2004.

GOAL

Complete evaluations of updated national codes and standards as they are developed and adopt those codes and standards that are deemed to be beneficial and cost effective in Nebraska.

Public Buildings

State and local public buildings use a significant amount of energy for many applications including heating, cooling, ventilation, control systems and lighting and many of these public buildings are older and have less efficient building systems. Adding to these challenges, these government entities continually experience budget challenges regarding income revenue, extension of services and continuous operation. Although Nebraska enjoys relatively favorable energy prices compared to the rest of the nation, government entities are still obliged to maximize their energy efficiency and reduce the tax burden on their citizens.

BACKGROUND

From 1981-1996 the Energy Office operated the School District Energy Efficiency Program that funded energy audits and energy efficiency improvements in K-12 public school buildings. Through June 1996 more than $32.8 million in grants and loans were made to the state's school districts. In May of 1995 the legislature created a technology fund for the state's schools and financed the new program with the funds from the School District Energy Efficiency Program. Also in 1996, Congress did not appropriate any funds for the federal Institutional Conservation Program which was administered through the Energy

Office and also provided grant funds for energy audits and energy efficiency improvements in public school districts.

In 1993 - 1994 the Energy Office worked with the Environmental Protection Agency (EPA) and numerous state agencies to fulfill the State of Nebraska's commitment to the EPA's GreenLights program. Lighting surveys with improvement recommendations were completed on 2,760 state owned buildings. It was estimated that the state could save more than $2.1 million annually from electricity and maintenance costs following implementation. Financing assistance was also made available through the Energy Office and Task Force 309.

In 1998 and 1999 the Energy Office partnered with the Nebraska Military Department to complete energy assessments on 44 buildings to recommend cost-effective energy efficiency improvements and to fund a resource energy manager position with the Nebraska National Guard to assist in implementing the energy saving improvements identified in the assessments.

Additionally, 5% financing through the Dollar and Energy Saving Loan Program is available to local governments (excluding K-12 public school districts) for completing energy efficiency improvements in local government facilities. As of September 30, 2008, 49 local government projects utilizing over $1.2 million in loan funds have been invested in energy efficiency improvements.

There are currently initiatives that favor public buildings "leading the way" to energy and environmental efficiency by implementing high performance green building standards in new construction and building renovation projects.

GOAL

Support state and local government initiatives to increase energy efficiency in both new and existing public building stock.

Private Sector Buildings

RESIDENTIAL

Housing costs are commonly thought of in terms of mortgage or rent payments, but utility costs can account for a significant share of a monthly budget. In the case of low-income households, the monthly income percentage attributed to utility costs can be surprisingly high. The overall increases in energy costs and the volatility that energy markets have experienced in the last decade, have served as a catalyst for increased energy efficiency in both new and existing residential buildings.

According to the U.S. Department of Energy's Energy Information Administration, Nebraska's residential building sector consumed more than 23percent of the total energy within the state since 2000. The latest state housing statistics indicate that an average of 7,155 single family homes have been constructed in Nebraska over the past 10 years. The impact of this new construction presents a mixed picture regarding future energy use. Historically, existing homes have tended to use more energy than new homes but many new homes are integrating more energy intensive features which may change this traditional interpretation.

BACKGROUND

Homes built in Nebraska prior to 1981 were built without any energy efficiency requirements. The first energy code to impact residential construction was the Nebraska Building Energy Conservation Standard Act passed in 1980. This code was updated in 1983 to the Model Energy Code (MEC) developed by the Council of American Building Officials. The residential energy code remained unchanged until 2004 when the Nebraska Unicameral adopted the 2003 International Energy Conservation Code as the Nebraska Energy Code for all new buildings constructed within the state and for substantial renovation projects.

Voluntary programs continue to be made available through a number of Nebraska Energy Office programs. The Weatherization Assistance Program provides no-cost energy efficiency improvements to low-income Nebraskans. More than 59,000 homes have been weatherized since 1979. The Rebuild Nebraska Program, funded through a State Energy Program Special Projects Grant provided no-cost energy audits for multi-family building owners from 1996 thru 1999. The Energy Office also continues to maintain its partnership with the Environmental Protection Agency's Energy Star program, promoting energy efficiency in all aspects of residential energy use. Low interest 5 percent financing through the Dollar and Energy Saving Loan Program has been available since 1990 to existing single and multi-family building owners for completing energy efficiency

improvements. As of September 30, 2008, more than 23,000 residential and Rebuild Nebraska projects have utilized more than $71.7 million in loan funds to make energy efficiency improvements.

The Energy Office developed and operated the Nebraska Energy Efficient Mortgage Program in 1996 and 1997 to encourage the construction of new homes that exceeded minimum energy code compliance. Due to limited funding, the program was suspended in 1998 and modified in late 2000 to include not only energy efficiency improvements but also improvements that would lessen the impact of new construction on Nebraska's environment. The Nebraska Certified Green BuildSM program has been certifying new homes since May of 2003. Although the program does not include a financing mechanism, the number of certified homes continues to increase on an annual basis with 20 certified homes and 85 housing units currently under construction.

There are currently initiatives that favor Nebraska "leading the way" to energy and environmental efficiency by implementing high performance green building standards in all new construction.

GOAL

Improve the energy efficiency of existing and future Nebraska homes through a combination of approaches including strengthening code enforcement in new construction, educating members of the state's construction industry of the benefits associated with "above code construction" and utilizing creative financial incentives to improve efficiency in existing homes and new construction.

COMMERCIAL/INDUSTRIAL BUILDINGS

Fuels most commonly used in the commercial sector are electricity and natural gas, and expand slightly in the industrial sector to include coal and various other petroleum products. Commercial energy use includes non-manufacturing business establishments, and local, state, and federal governments. Manufacturing, construction, mining, agriculture and forestry make up energy use in the industrial sector. Nebraska's commercial and industrial sectors account for just over 50% of the state's total energy use, with 31% being utilized in the industrial sector.

Nebraska's commercial and industrial sectors encompass a wide range of activities from agriculture to limestone mining, the manufacture of automotive and agricultural products, steel production, to internationally recognized investment and insurance firms. Nebraska is also among the nation's top leaders in ethanol production. In 2005 these activities accounted for 332 trillion British Thermal Units (Btu) of Nebraska's total energy consumption, 655 trillion Btus. The total energy consumption in these sectors was comprised of 199 trillion Btus from electricity, 69 trillion Btus from natural gas, 8 trillion Btus from coal, and 56 trillion Btus from petroleum products. The industrial sector accounted for 61 of the 64 trillion Btus consumed from coal and petroleum products.

A large percentage of commerce and industry's production costs stem from dollars spent on energy. Most of their energy expenditures are used to purchase electricity and natural gas. Those two energy markets affect the manufacturing sector. In turn, commerce and industries high market share for both energy sources affects the natural gas and electricity markets. Focus on energy conservation in this area is imperative to maintaining lower electric and natural gas costs, and also in maintaining lower costs for the goods provided.

Energy use in commerce and industry stem from building and manufacturing processes. Key factors affecting building energy use are the building envelope, lighting, hot water and heating ventilating and air conditioning (HVAC), with HVAC being further affected by internal gains from people, appliances, lighting, and the various manufacturing processes. Key factors affecting energy use in manufacturing processes are motor loads and process heating and cooling requirements. These factors can be affected by advancement of energy codes and energy conservation measures such as energy management programs and energy audits leading to power factor correction and improvement, direct machine drives, higher efficiency equipment, building upgrades, timely maintenance, and continuous control system monitoring and adjustment.

GOAL

Promote the efficient use of energy by advancing cost effective building codes and increasing awareness of state of the art energy efficiency measures to increase profits through energy savings, thus providing Nebraska businesses with an aid in maintaining a competitive edge in the market place.

OTHER BUILDINGS

While consumption and energy sources are important factors for Nebraska's energy security, conservation is also extremely important. Energy conservation can reduce consumption and the need for energy. There are numerous ways and technologies that can aid in conserving energy.

Planting drought tolerant trees and grasses reduces the need for water in landscape design, reducing the energy used to provide that water. Trees planted for shade or as wind breaks reduce heating and cooling energy needs. Conversion from gravity irrigation to center pivot, or from high pressure to low pressure pivot irrigation reduces water pumping requirements and the energy it uses. Conversion to no-till, or minimum tillage farming practices reduces energy required to grow crops.

Too often codes are viewed as standards. Codes are minimums and only reflect the least efficient building that can legally be constructed. Exceeding code requirements through the use of more efficient heating and cooling equipment, efficient appliances, motors, lighting, increased insulation levels, and efficient windows and doors are important energy efficiency measures that reduce energy needs.

Programs such as Nebraska's Dollar and Energy Saving Loans, Energy Star® and the Consortium for Energy Efficiency's High Efficiency Commercial Air Conditioning and Heat Pump Initiative provide ratings that spotlight efficient products, and are valuable energy saving resources to Nebraska businesses and consumers.

GOAL

Encourage, promote, and support energy conservation and efficiency technologies and programs, and provide technical assistance and information to Nebraska's residents.

Energy Education

Nebraskans are proud of our educational system. Standard aptitude scores and college entrance exams rank above the national average. Nebraska has an excellent post secondary educational system built on the foundation of technical community colleges, state and private colleges and the University system. However, a 2002 Roper Starch study found that just 12 percent of Americans were able to pass a basic quiz on energy topics. Most would agree that effective education on energy resources and energy-related issues give Nebraskans the tools to make informed choices about the use of energy resources.

The Nebraska Energy Office has been actively involved in providing energy education, but it has been targeted to specific needs such as Energy Code training for builders, code officials and others involved in Nebraska's construction industry. Funding for energy education is limited as available resources have declined significantly over the past 15 years.

Adult education offers an opportunity to make a significant impact on Nebraskans. As energy costs become a higher percentage of the family budget, Nebraskans should be eager for opportunities to learn about methods of reducing their monthly heating and cooling bills.

It is yet to be decided whether energy education should be aimed at K-12 public schools, junior colleges, the general public, targeted audiences or all four. The Energy Office hopes Nebraskans will answer that question through these public opportunities to provide written and oral testimony on the proposed Energy Plan.

GOAL

Support efforts to provide Nebraskans with a wide variety of energy data and information resources to assist them in making informed energy decisions.

CURRICULUM DEVELOPMENT — RENEWABLE ENERGY

Interest in renewable energy systems in Nebraska has increased significantly over the past several years. During those years, Nebraskans have witnessed the construction of numerous ethanol plants. There may be a similar development in the area of solar and wind on the horizon. What appears to be lacking though is an infrastructure of trained technicians capable of installing and servicing solar and wind systems. States such as Massachusetts, North Carolina, Oregon and others have developed curriculum and programs designed to graduate competent energy professionals.

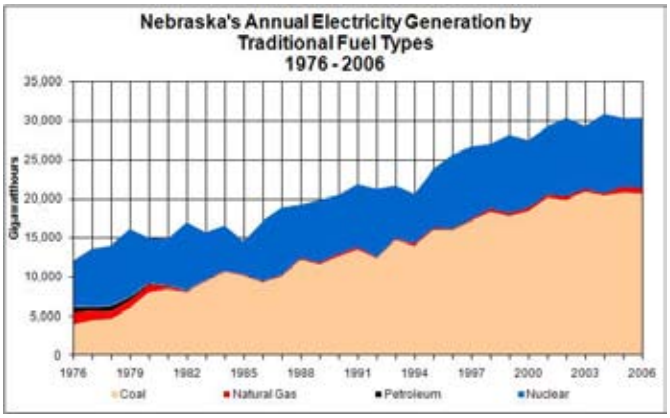
GOAL

Nebraska should become a leader in the development of renewable energy curricula at the technical community college level that will produce graduates capable of filling the expanding need for qualified installers of renewable energy systems.

Electric Generation

TRADITIONAL SOURCES

Trends in the electric power sector in Nebraska have remained generally constant over time: more than 90 percent—94 percent in 2006—of the traditional fuels and renewable fuels used to generate, distribute and transmit electricity has come from just two resource types: coal and nuclear electric power. Generators using natural gas and petroleum provided 2.4 percent and 0.06 percent, respectively, of the state's electric power.



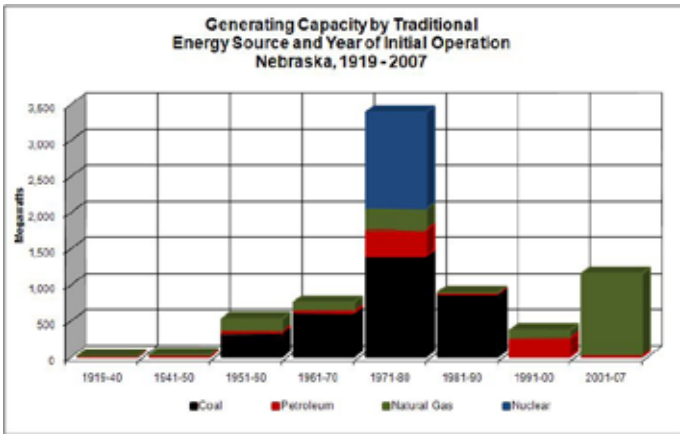
ELECTRIC POWER EMISSIONS

Over the last ten years, electric power emissions in the state have consisted of about 20 million metric tons of carbon dioxide, 65 thousand metric tons of sulfur dioxide, and 60 thousand metric tons of nitrogen oxide each year. In 2006, electric power generated by coal emitted 21 million metric tons of carbon dioxide, 65 thousand metric tons of sulfur dioxide, and 41 thousand metric tons of nitrogen oxide. Electric power generated by natural gas emitted 1.2 million metric tons of carbon dioxide, five metric tons of sulfur dioxide, and 19 thousand metric tons of nitrogen oxide. Electric power generated by petroleum emitted 18 thousand metric tons of carbon dioxide, 27 metric tons of sulfur dioxide, and 179 metric tons of nitrogen oxide.

Year	Energy Source	Carbon Dioxide (Metric Tons)	Sulfur Dioxide (Metric Tons)	Nitrogen Oxide (Metric Tons)
2006	Coal	21,086,860	65,068 41,429	41,429
2006	Natural Gas	1,187,904	5	18,819
2006	Petroleum 1	8,326	27	179

Generating Capacity by Traditional Energy Source a Year of Initial Operation

The majority of generating capacity by traditional energy sources came online during 1971-1980.



Generating Units and Capacity by Energy Sources

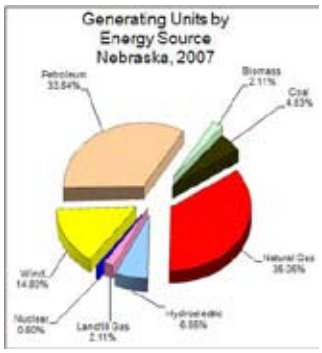
At the beginning of 2007, Nebraska had 16 coal power generating units, 116 natural gas energy generating units, 2 nuclear energy generating units, and 112 petroleum power generating units with a total of 7,088 megawatts capacity. These units provided 6,716 megawatts net summer capacity and 6,790 megawatts net winter capacity.

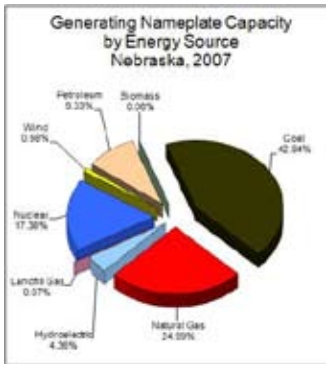
Number of Units and Generating Capacity by Traditional Energy Source Nebraska, 2007
(As of January 1)

Primary Energy Source	Number of Units or Turbines	Generator Nameplate Capacity [Megawatts (MW)]	Net Summer Capacity (MW)	Net Winter Capacity (MW)
Coal	16	3,211.600	3,203.700	3,081.900
Natural Gas	116	1,873.800	1,632.330	1,726.650
Nuclear Energy	2	1,303.000	1,238.340	1,282.800
Petroleum	112	699.200	641.920	698.560
Total	246	7,087.600	6,716.290	6,789.910

Nameplate Capacity

Most of the nameplate capacity is provided by generators using coal (43 percent), natural gas (25 percent), nuclear energy (17 percent), and petroleum (nine percent). Five (5) percent of the generating units use coal which contributes 43 percent of the state's electricity capacity, and less than one percent of the units use nuclear energy which contributes 17 percent. Thirty-five (35) percent of the generating units use natural gas which contributes 25 percent of Nebraska's electricity capacity and 34 percent of the units use petroleum which contributes nine percent.





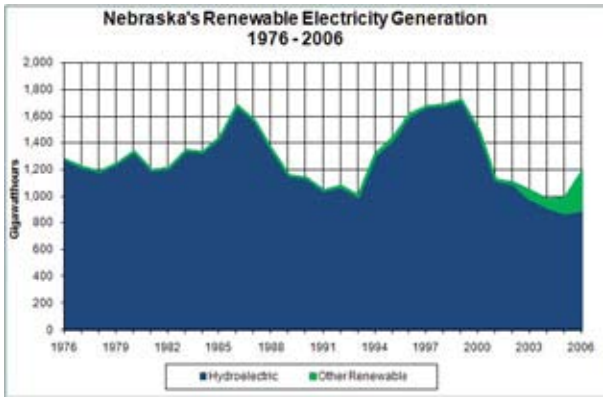
GOAL

Utilize new technologies to improve the efficiency of conventional energy sources. Maintain efforts to operate conventional generating plants in an environmentally safe manner.

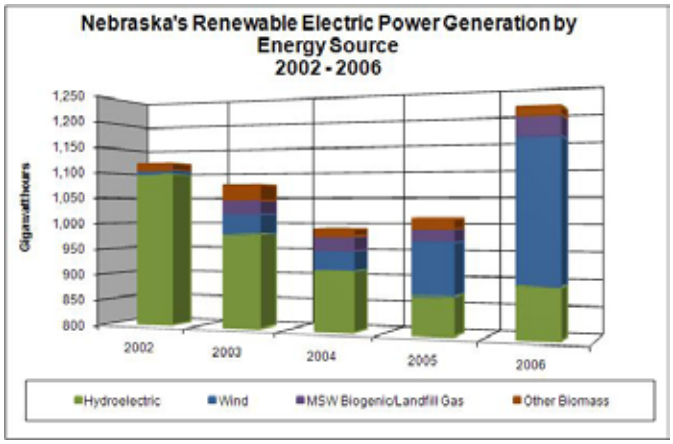
RENEWABLE SOURCES

Electricity generation in the state was 31,599 gigawatthours (GWh) in 2006. Nearly three percent was generated by hydroelectric power, 0.8 percent was generated by wind power, 0.12 percent was generated by Municipal Solid Waste (MSW) biogenic/landfill gas, and 0.05 percent was generated by other biomass. In total, nearly four percent was generated by renewable sources in 2006.

For 30 years, hydroelectric resources have provided the largest portion of renewable energy development in the state. However, the share of hydroelectric generation is shrinking due to growth of developing renewable energy resources.



From 2002 to 2006, hydroelectric power fell from 98 percent to 74 percent of the renewable sources generating, distributing and transmitting electricity in the state. Renewable sources of electric power generation in Nebraska include conventional hydroelectric power, geothermal, solar, wind, wood/wood waste, Municipal Solid Waste (MSW) biogenic/landfill gas, and other biomass.



Other biomass includes agricultural byproducts/crops, sludge waste and other biomass solids, liquids and gases. Municipal Solid Waste biogenic includes paper and paper board, wood, food, leather, textiles and yard trimmings. Data for solar energy and geothermal energy is scarce. Utility-scale wind power generation is readily tracked while small-scale wind power is not (wind-powered electric systems sized for homes, farms, and small businesses).

Electric Power Emissions

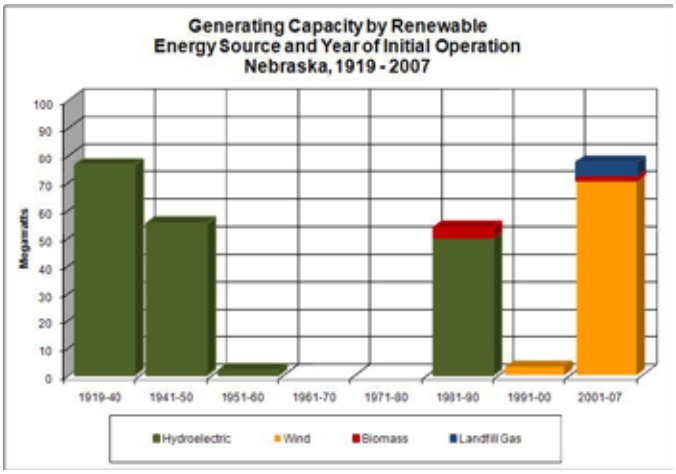
Over the last ten years, electric power emissions in the state have consisted of about 20 million metric tons of carbon dioxide, 65 thousand metric tons of sulfur dioxide, and 60 thousand metric tons of nitrogen oxide each year. In 2006, electric power generated by renewable energy sources emitted 877 metric tons of nitrogen oxide.

Year	Energy Source	Carbon Dioxide (Metric Tons)	Sulfur Dioxide (Metric Tons)	Nitrogen Oxide (Metric Tons)
2006	Renewable	0	0	877

Generating Capacity by Renewable Energy Source and Year of Initial Operation

During 1919-1960, new hydroelectric power generation contributed 132.9 megawatts of capacity to Nebraska's electricity generation. During 1981-1990, 3.5 megawatts of biomass energy generation capacity and 50 megawatts of hydroelectric power capacity became operational. Of the capacity added during 1991-2000, 3.0 megawatts were from wind power.

During 2001-2007, energy from wind power contributed 70.57 megawatts capacity, landfill gas contributed 5.6 megawatts, and biomass contributed 1.08 megawatts.



Generating Units and Capacity by Energy Sources

At the beginning of 2007, Nebraska had seven biomass energy generating units, 22 hydroelectric power generating units, seven landfill gas energy generating units, and 48 wind turbines with a total of 410 megawatts capacity. These units provided 356 megawatts net summer capacity and 349 megawatts net winter capacity.

Number of Units and Generating Capacity by Renewable Energy Source
Nebraska, 2007 (As of January 1)

Primary Energy Source	Number of Units or Turbines	Generator Nameplate Capacity [Megawatts (MW)]	Net Summer Capacity (MW)	Net Winter Capacity (MW)
Biomass	7	4.580	4.517	4.517
Hydroelectric	22	326.600	272.280	266.070
Landfill Gas	7	5.600	5.600	5.600
Wind	48	73.160	73.160	73.160
Total	84	409.940	355.557	349.347

NamePlate Capacity

Of the generating units in the state, 26 percent used renewable fuels (hydroelectric power, wind, biomass, and landfill gas) in 2007, which contributed five percent of the nameplate capacity.

GOAL

Utilize new or alternative energy sources to reduce dependency on petroleum-based fuels in an environmentally safe manner.

Energy Research

Research on energy technologies from sources such as the Pacific Northwest National Lab, National Renewable Energy Laboratory and other national laboratories as well as Nebraska's own universities are an important source for the latest energy efficiency and conservation technologies.

The Energy Systems Laboratory at the University of Nebraska-Lincoln has fostered substantial savings for a number of businesses and industries throughout the state by utilizing Continuous Commissioning developed at the Laboratory. These efforts are made possible, in part, by federal grants awarded to the Energy Office.

The Energy Office, working closely with researchers, investigates the cost effectiveness of changes to the International Energy Conservation Codes (IECC), which is the state's energy code. These efforts are also made possible by federal grants awarded to the Energy Office.

Numerous other research studies have been funded by the Energy Office. The results of those studies are available to Nebraska residents on the Energy Office's web site.

Competitive grant opportunities are at times available to promote new energy technologies. The Energy Office constantly monitors the availability of these funding opportunities and has been successful in competing for this type of funding..

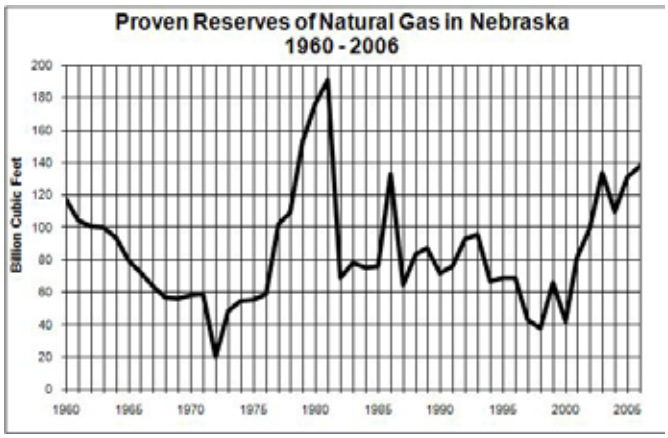
GOAL

Partner with others in the state to advance energy research and energy efficiency goals that result in the financially and environmentally responsible use and production of energy.

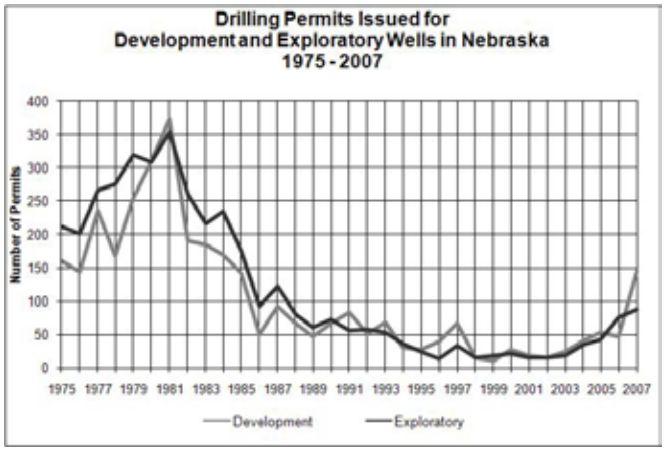
Fossil Fuels

NATURAL GAS

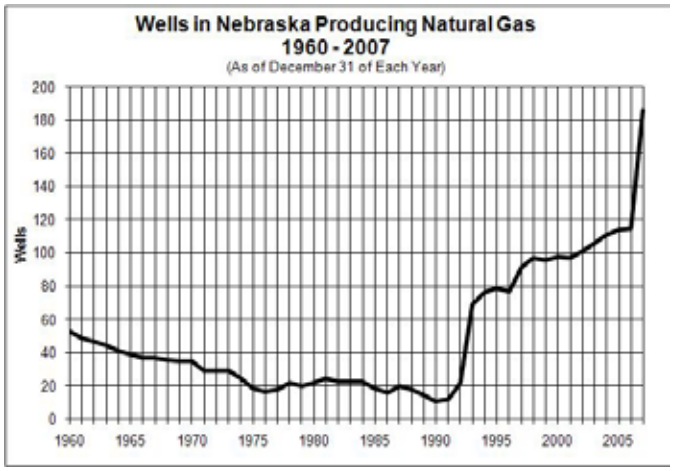
In 2006, Nebraska had 138 billion cubic feet of proven dry natural gas reserves. Proven reserves are the estimated quantity of natural gas which geologic and engineering data demonstrate with a given probability to be recoverable in the future assuming current costs of operation and market prices. Nebraska's reserves peaked in 1981 at 191 billion cubic feet. Beginning in 1977, Nebraska's reserves have been included with a group of miscellaneous states, including Arizona, Illinois, Indiana, Maryland, Missouri, Nevada, Oregon, South Dakota, and Tennessee.



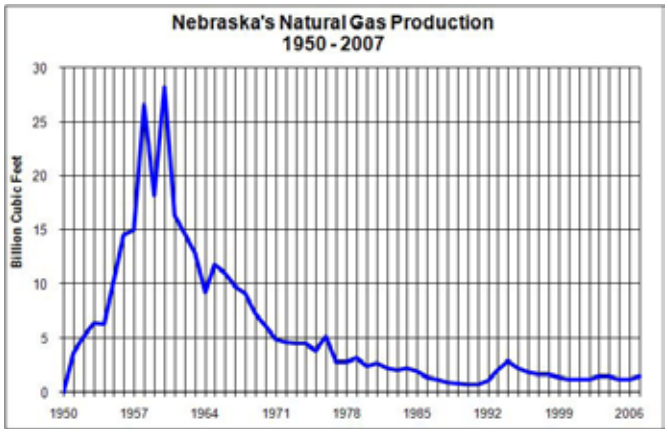
An increasingly favorable economic environment has driven up the number of drilling permits issued in recent years. Drilling permits issued for exploratory wells increased 16 percent in 2007 from 2006 whereas drilling permits issued for development wells tripled in 2007 from 2006. The number of permits issued peaked in 1981. Note that the number of permits includes both crude oil wells and natural gas wells.



There were 186 wells producing natural gas in 2007, an increase of 62 percent from 2006 when there were 115 wells. In the early 1990s, the number of producing wells started increasing. Over the last decade, the increases have been small but steady until 2007.



Natural gas production for 2007 was 1.6 billion cubic feet, an increase of 28 percent from 2006 when production was 1.2 billion cubic feet. Production peaked in 1960 at 28.2 billion cubic feet. During the last 30 years, production has declined.



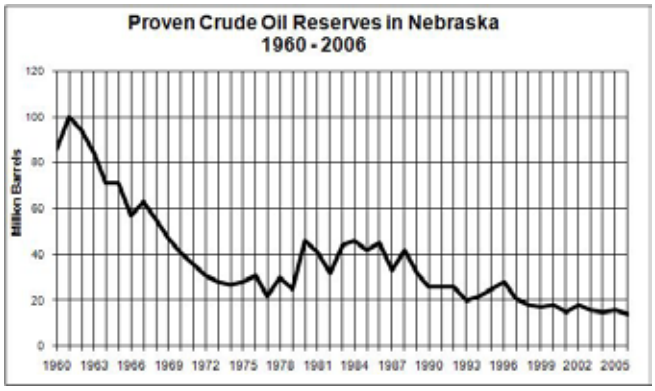
In 2005, Nebraskans consumed 119.1 billion cubic feet of natural gas. Consumption is not available for more recent years. Nebraska's natural gas production in 2005 was 1.2 billion cubic feet which represented only 1 percent of the natural gas consumed in the state. Natural gas consumption has been relatively stable since 1960. Natural gas is a major fuel used for heating homes. Natural gas heats 456,979 households in Nebraska (or 65.2 percent). Based on the latest federal figures, Nebraska's natural gas consumption accounts for 6.1 million metric tons of carbon dioxide emissions.

GOAL

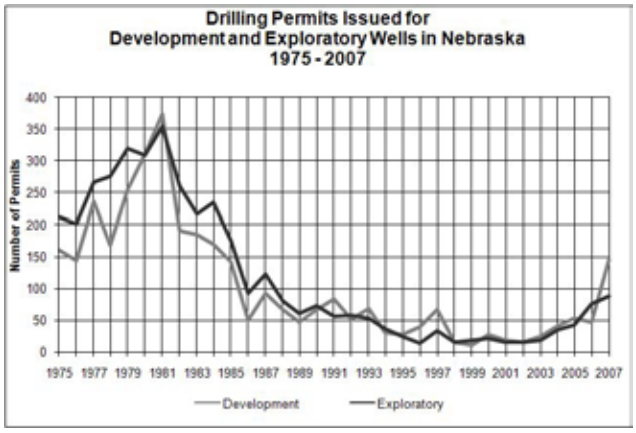
Promote the production, efficient use and continued price competitiveness of natural gas because of its environmental quality and abundant supply.

OIL

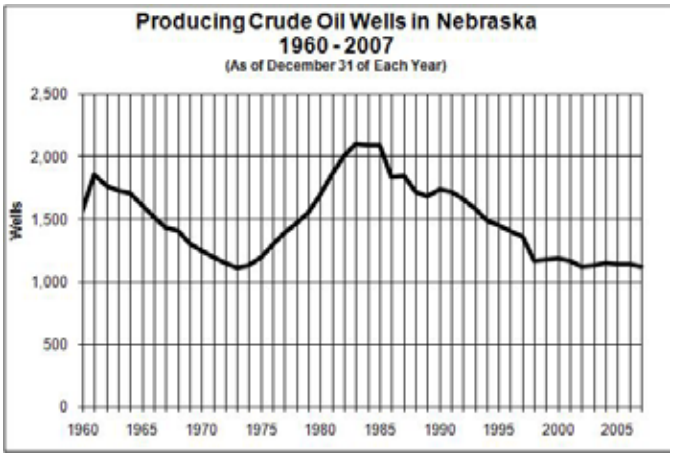
Most of Nebraska's small oil reserves are located in the western half of the state. In 2006, Nebraska had 14 million barrels of proven crude oil reserves. Proven reserves are the estimated quantity of crude oil which geologic and engineering data demonstrate with a given probability to be recoverable in the future assuming current costs of operation and market prices. Proven reserves peaked in 1961 at 100 million barrels. Since then, even with some activity during the 1980s, the number has declined to less than 20 million barrels.



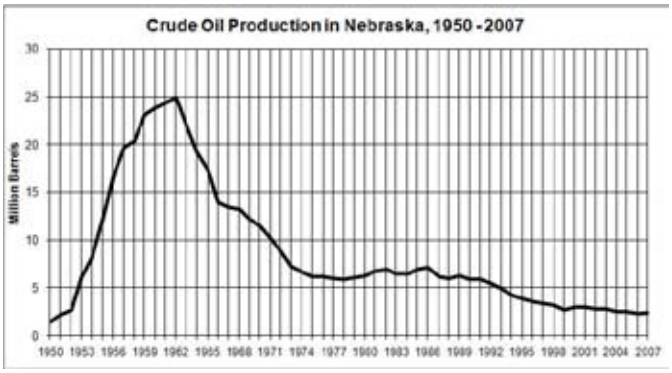
An increasingly favorable economic environment, which included high crude oil prices, has driven up the number of drilling permits issued in recent years. Drilling permits issued for exploratory wells increased 16 percent in 2007 from 2006 whereas drilling permits issued for development wells tripled in 2007 from 2006. The number of permits issued peaked in 1981. Note that the number of permits includes both crude oil wells and natural gas wells.



During the 1960s and early 1970s, the number of wells producing crude oil gradually declined each year until the oil embargo of 1973. The number reversed course to peak in 1983 at 2,100. The number of wells has been on a decline until 1998 when the number stabilized. In 2007, there were 1,116 wells in the state producing crude oil.



Crude oil production for 2007 was 2,335,375 barrels or 6,398 barrels per day, an increase of one percent from 2006 when annual production was 2,312,955 barrels or 6,337 barrels per day. Production peaked in 1962 at 24.9 million barrels. From 1962, production fell until the mid-1970s. Through the 1980s, Nebraska experienced stable production around six million barrels. Since then, production has been in a steady decline.



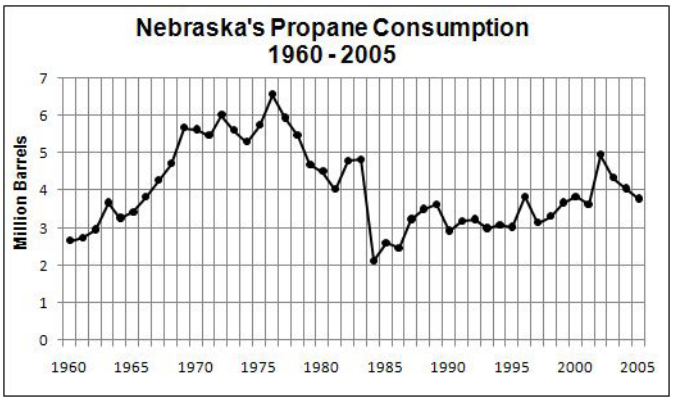
In 2005, Nebraskans consumed 43,209,000 barrels of petroleum products or 118,380 barrels per day; consumption is not available for more recent years. Nebraska's crude oil production in 2005 was 2,413,452 barrels or 6,612 barrels per day which represented only 5.6 percent of the petroleum products consumed in the state. In the early 1970s there was a drop in consumption, but otherwise, crude oil consumption has been slowly but steadily on the rise since 1960.

GOAL

Stimulate Nebraska petroleum production to aid the economic development of oil producing regions and to reduce dependency on out-of-state and foreign petroleum. Review the state's severance tax structure and make appropriate changes to encourage production.

PROPANE

Propane is a by-product of two other processes: natural gas processing and petroleum refining. This indicates that propane is impacted by both natural gas and petroleum events. High natural gas prices can create an incentive not to produce propane. High natural gas prices can also cause petroleum refiners to switch from natural gas to propane to fuel their own refineries.



Propane is used for heating homes, heating water, cooking and grilling, drying clothes, fueling gas fireplaces, as an alternative fuel for vehicles, and to make petrochemicals which are the building blocks for plastics, alcohols, fibers, and cosmetics. Based on the latest federal figures, 63,080 households in Nebraska (or nine percent) use propane for heating.

Propane consumption has had its ups and downs since 1960 but never reached above 7 million barrels. Peak consumption was in 1976 at 6.6 million barrels. In 1960, Nebraskans consumed 2.65 million barrels of propane whereas, in 2005, Nebraskans consumed 3.768 million barrels.

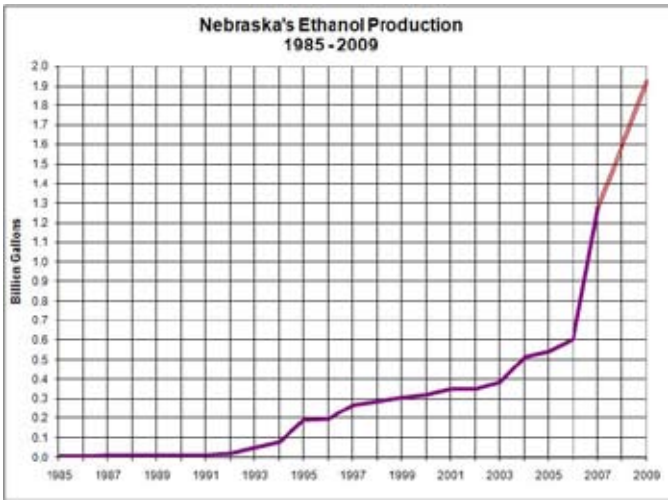
GOAL

Evaluate the formation of a state propane commission to license dealers, set certification standards for industry employees and oversee and regulate the potential production, importation, distribution, storage, handling and safety of propane in Nebraska.

Renewable Energy

BIOMASS

Biomass is defined as any organic material made from plants or animals. With agriculture being one of Nebraska's primary industries, energy from biomass is an important resource. Biomass is the only clean, renewable energy source that can help to significantly diversify transportation fuels. As a national leader in corn production, Nebraska is also among the Nation's top producers of corn-based ethanol.



Biomass energy comes from many different sources. Corn and soybeans can be used to produce ethanol, a gasoline substitute and biodiesel, a diesel fuel substitute. Human and animal waste can be processed through a digester to make methane, which can be used for heating or used as a fuel to make electricity. Wood and wood waste can be burned as a source of heat, or run through a process called gasification to produce combustible gases that can in turn be used for heat or as a fuel to generate electricity. Cellulosic materials from plant residue, corn stalks, switch grass, etc. can also be used to make ethanol.

In 2005 Biomass energy represented 13 trillion British Thermal Units (Btus) of Nebraska's 655 trillion Btus of energy consumption. Nebraska's primary biomass consumption was composed of 9 trillion Btus from wood and wood waste and 4 trillion Btus from ethanol. Wood and waste wood is primarily used in residential space heating.

In 2007, ethanol production capacity in Nebraska doubled from the previous year to reach nearly 1.3 billion gallons due to plants completing expansion projects and plants becoming operational. In 2008, ethanol production is projected to increase 24 percent from 2007 due to three plant expansions and one plant becoming operational. In 2009, ethanol production is expected to increase from 2008 as the result of possibly five ethanol plants becoming operational and with many plants under consideration.

The University of Nebraska and the national laboratories continue to conduct research to further the use and efficiency of conversion of biomass to energy.

GOAL

Continue to promote and support research as well as the growth and use of biomass energy in Nebraska.

HYDROPOWER

Hydropower is defined as power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. It is one of the oldest sources of energy. Hydropower could be viewed as an ideal fuel for electricity generation because it is nearly free, there are no waste products, and hydropower does not pollute the water or the air. There are many forms of hydropower: conventional, ocean energy, wave energy, tidal energy, and hydrokinetic energy to name a few. In Nebraska, hydropower projects are entirely conventional hydropower. Hydropower is the principal source of renewable energy in the state. It provides nearly three percent of electricity generated by renewable sources.

Hydropower is a domestic source of clean, renewable, reliable, efficient, and affordable electricity. Hydropower also provides recreational enhancements, flood control, and irrigation. Like wind, solar, and geothermal energy, hydropower's "fuel" is more or less infinite and is not exhausted during electricity generation. Water from rivers is a domestic resource that will not face disruption from foreign suppliers.

Hydropower turbines are capable of converting more than 90 percent of available energy into electricity. Hydropower is currently the most efficient way to generate energy. Each kilowatthour of hydroelectricity is generated at an efficiency more than twice that of other energy resources.

GOAL

Continue the use and further development of hydropower as an energy source as new technologies improve cost-effectiveness.

SOLAR

According to the U. S. Energy Information Administration, Nebraska has good solar resources, especially in the western part of the state. In 2005, of the 655 trillion British thermal units (Btus) Nebraska consumed, 200 billion Btus came from solar production. Solar energy production in Nebraska comes primarily from photovoltaic systems deployed in remote areas where it is less expensive than installing new power lines. There are a few solar water heating systems in the residential sector and many buildings have been designed incorporating passive solar. Solar activity in the state peaked in the early 1980s and phased out gradually when the federal and state tax credits expired. However, with the renewed interest in "green" technology and energy efficiency, builders, homeowners and designers are once again looking at renewable applications.

The state's inexpensive cost of electricity makes it difficult for active solar systems to be cost competitive. The most recent cost studies indicated solar systems produce electricity between 16-32 cents a kilowatthour compared to average electricity costs in Nebraska of 6-8 cents a kilowatthour.

Efficiencies in energy production are in the infancy stages, and there is potential for great advances. Current solar systems are capable of transforming only 15 to 20% of available solar energy into electricity. Scientists estimate that it is possible to increase efficiencies to harness up to 70% of available solar energy, and work at national laboratories is ongoing in an effort to accomplish that goal. Efforts have also been made to bring down the cost of solar equipment, and have resulted in concentrating on thin film solar technologies. Solar energy is clean and free of pollution, and most systems require very little maintenance.

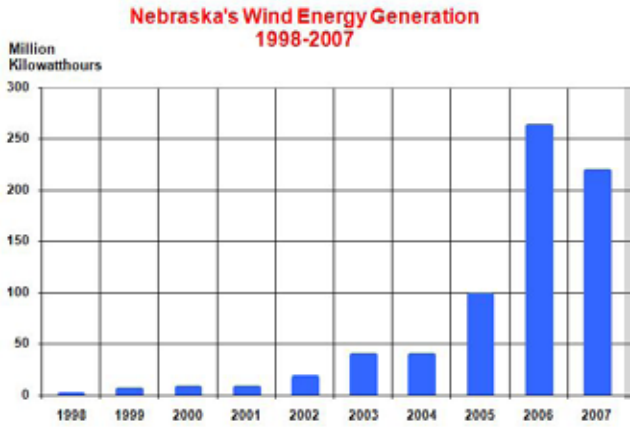
GOAL

Encourage and develop the use of solar energy in Nebraska and monitor developments in efficiency and cost effectiveness.

WIND

Wind energy, after ethanol, has seen the greatest growth in the state over the past decade. Wind power is the renewable energy resource currently most economically competitive, given the state's low electricity rates.

Three wind turbines (one from Lincoln Electric System and two from Nebraska Public Power District) began operation in December 1998. In 2007, more than 200 million kilowatthours were generated by wind energy in Nebraska. Currently, Nebraska has 44 operational turbines at three sites with a total capacity of about 70 megawatts. In the next six months, another 120 megawatts of wind power will be added by Nebraska Public Power District. Announced plans by Omaha Public Power District and Nebraska Public Power District indicate that up to 380 more megawatts of wind power are likely to be added over the next several years. According to the American Wind Energy Association in March 2008, the state ranked 21st in the nation in wind generation capacity.



Most wind studies show that Nebraska's wind energy potential is superior, ranking 6th among the states. The Energy Information Administration analysis of the state's wind resources concluded that about 46 percent of Nebraska contained good wind speeds suitable for development. The U.S. Department of Energy's 2008 report, *20% Wind Energy by 2030*, forecast that if the nation relied on wind energy to meet 20 percent of its needs, Nebraska has the potential to generate 7,800 megawatts of wind power. Development of the state's wind resources on this scale would have substantial economic impacts. A known barrier to increased wind generation is transmission line capacity in the windiest regions of the state.

GOAL

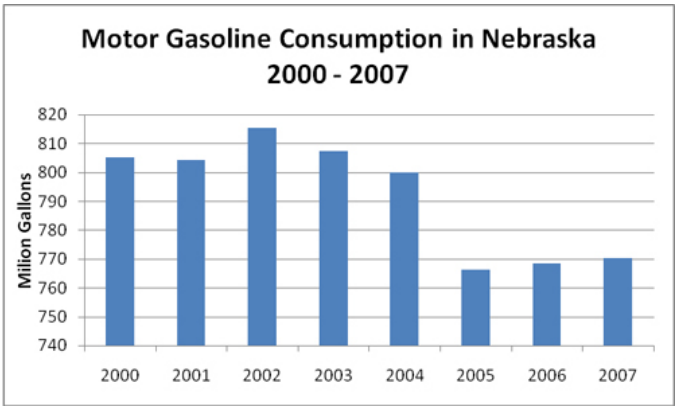
Promote the increased production and utilization of wind power for instate consumption as well as exportation to other states.

Transportation

GASOLINE AND DIESEL

Gasoline

Gasoline is the fuel most commonly used in the transportation sector. The vast majority of cars and light-duty trucks are dependent on gasoline as their fuel source. According to the Nebraska Department of Motor Vehicles' 2007 Annual Report, there are 2,148,061 light-duty vehicles registered in the state. Of this total, an estimated 1.5 million use gasoline or E-10 for fuel and another 70,000 are flex fuel vehicles, which have the option to use gasoline, E-10 or E85 for fuel.



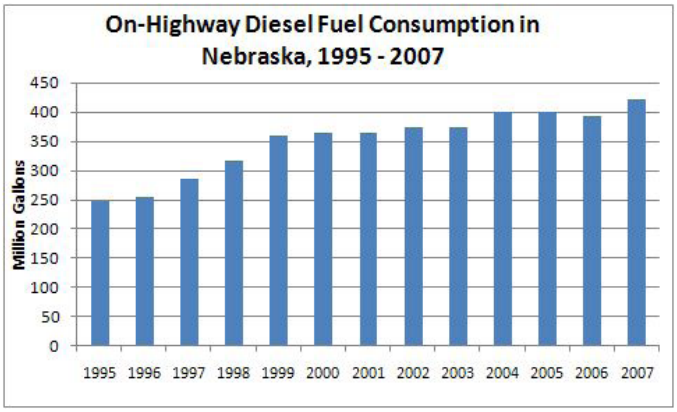
Nebraska is one of the few states that allow the use of conventional gasoline statewide. Three grades or octane levels of conventional gasoline are sold through 1,486 fueling stations located in the state. The three grades are regular unleaded with an 87 to 88 octane, midgrade with an 88 to 90 octane, and premium with a 91 and higher octane. Gasoline accounts for over half (54 percent) of the energy resources consumed in the transportation sector. Among the three grades of gasoline, Nebraska drivers in 2007 consumed 285,501,195 gallons of gasoline last year. Additionally, an estimated 483,951,478 gallons of gasoline were blended in E-10 and 814,733 gallons of gasoline were blended in E85. Total consumption of gasoline was an estimated 770,267,406 gallons. Over the eight-year period of 2000 to 2007, gasoline consumption was relatively stable for the first five years and then fell dramatically during the last three. The drop in consumption was attributed to the increase in gasoline prices resulting in gasoline conservation and the substitution of ethanol-blended fuel. The drop in consumption is also reflected in the market share of gasoline and ethanol-blended fuel. In 2007 Gasoline has a 34-percent market share compared to ethanol-blended fuels' 66-percent market share.

Key indicators that impact gasoline consumption in the transportation sector are population growth, number of miles traveled, and vehicle efficiency. Conservation has been attempted through various approaches: mandated Corporate Average Fuel Efficiency (CAFÉ) standards, reduced highway speed limits, vehicle efficiency technology, and driving modifications.

Population in the state has grown only 26 percent over the last 47 years indicating minimal impact on fuel consumption in the state. Petroleum dependency and carbon dioxide emissions will be reduced by concentrating Nebraskans' efforts on decreasing the number of miles traveled, increasing vehicle efficiency, and increasing alternative fuel consumption. If Nebraskans could decrease fuel consumption by ten percent with the proper maintenance of their vehicles, conserving road trips, and substituting an alternative fuel, the amount of gasoline could be reduced by more than 200,000 gallons daily. Carbon dioxide emissions could be reduced by nearly two thousand metric tons.

Diesel

Diesel fuel accounts for over a third of the energy resources consumed in the transportation sector. Over the 12-year period of 1995 to 2007, consumption of highway diesel fuel increased nearly 70 percent. Diesel fuel is sold through 1,638 fueling stations located in the state.



According to the Nebraska Department of Motor Vehicles' Annual Report, there are 2,148,061 vehicles registered in the state. An estimated 560,000 of the total vehicles use diesel fuel. In 2007, a total of 420,471,150 gallons were consumed.

Key indicators that impact diesel fuel consumption in the transportation sector are population growth, number of miles traveled, and vehicle efficiency. Conservation has been attempted through various approaches: mandated Corporate Average Fuel Efficiency (CAFÉ) standards, reduced highway speed limits, vehicle efficiency technology, and driving modifications.

Population in the state has grown only 26 percent over the last 47 years indicating minimal impact on fuel consumption in the state. Petroleum dependency and carbon dioxide emissions will be reduced by concentrating Nebraskans' efforts on decreasing the number of miles traveled, increasing vehicle efficiency, and increasing alternative fuel consumption. If Nebraskans could decrease fuel consumption by ten percent with the proper maintenance of their vehicles, conserving road trips, and substituting an alternative fuel, the amount of diesel fuel could be reduced by more than 100,000 gallons daily.

GOAL

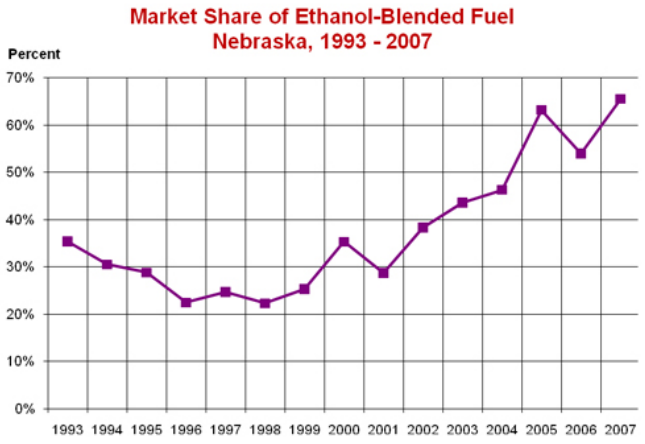
Create policies and programs to promote fuel efficiency, reduce dependence on petroleum and improve air quality in Nebraska.

ETHANOL AND BIODIESEL

Ethanol

In Nebraska, most ethanol is sold in a blended fuel--10 percent ethanol with 90 percent gasoline (called E-10) or 85 percent ethanol with 15 percent gasoline (called E85). Ethanol-blended fuel is a substitute for conventional petroleum-based gasoline. Over the last decade, the market share of ethanol-blended fuel has increased to 66 percent while gasoline's market share has dropped to 34 percent. Currently, there are 1,486 E-10 fueling stations and 46 E85 fueling stations.

According to the 2007 Nebraska Department of Motor Vehicles' Annual Report, there are 2,148,061 light-duty vehicles registered in the state. Of this total, an estimated 1.5 million use gasoline or E-10 for fuel and another 70,000 are flex fuel vehicles, which have the option to use gasoline, E-10 or E85 for fuel.



The use of alternative fuels allows Nebraska to continue its compliance with federal air quality standards. By consuming E-10 and E85, less pollution is emitted into the air than would be if gasoline were consumed. Ethanol has about two-thirds of the energy when compared with conventional petroleum-based gasoline, but while drivers may get less miles-per-gallon on a British Thermal Unit basis, drivers are also getting a higher-octane, less-polluting fuel.

Petroleum dependency and carbon dioxide emissions will be reduced by concentrating Nebraskans' efforts on decreasing the number of miles traveled, increasing vehicle efficiency, and increasing alternative fuel consumption.

GOAL

Continue the state policy of increasing production of and demand for ethanol to lessen our dependence on foreign oil, provide local economic development, enhance the price of local grain products and provide for improved air quality.
Encourage research in the ethanol area to reduce the amount of energy used to produce ethanol, including the energy required in the production of corn or other source material.

Biodiesel

Biodiesel is the name of a clean burning alternative fuel produced from domestic, renewable resources. Biodiesel is simply diesel fuel made from a variety of biomass sources. It can be grown domestically rather than pumped out of the ground from foreign sources. Soybeans are a good source and the most

common feedstock for biodiesel, but many other crops and plants including flax, mustard, rapeseed, sunflower, palm, hemp, jatropha, and pennycress can also be used. Biodiesel can also be made from animal fats and waste vegetable oil. Biodiesel can be blended at any level with petroleum diesel to create a biodiesel blend. It can be used in compression ignition (diesel) engines with no major modifications. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulfur and aromatics. Biodiesel is the best greenhouse gas mitigation strategy for today's medium and heavy-duty vehicles.

Biodiesel actually has the highest "energy balance" of any transportation fuel. The U.S. Department of Energy/United States Department of Agriculture lifecycle analysis shows for every unit of fossil energy it takes to make biodiesel, 3.2 units of energy are gained. This takes into account the planting, harvesting, fuel production and fuel transportation to the end user.

Standard diesel engines will operate on biodiesel. In cold weather, biodiesel begins to cloud and thicken at about 30 degrees Fahrenheit. Biodiesel thickens at warmer temperatures than No. 2 diesel fuel, but additives are available that will lower the pour point. Pour point is the point at which flow of the fuel ceases. Mixing biodiesel with No.1 diesel as is currently done with No. 2 will lower the pour point. Installing an in-tank or fuel line heater may also be needed to keep the fuel flowing in cold weather. A blend of biodiesel/diesel fuel has a lower pour point than 100% biodiesel, but gelling may still occur unless care as mentioned earlier is taken.

According to the 2007 Nebraska Department of Motor Vehicles' Annual Report, there are 2,148,061 vehicles registered in the state. Of this total, an estimated 560,000 are able to use biodiesel.

Biodiesel meets approximately 0.15 percent of diesel consumption which, in 2007, would have been 630,707 gallons. Currently, there are seven retail biodiesel fueling stations.

The use of alternative fuels allows Nebraska to continue its compliance with federal air quality standards. By consuming biodiesel, less pollution is emitted into the air than would be if conventional petroleum-based diesel were consumed.

Petroleum dependency and carbon dioxide emissions will be reduced by concentrating Nebraskans' efforts on decreasing the number of miles traveled, increasing vehicle efficiency, and increasing alternative fuel consumption.

GOAL

Encourage the use of biodiesel as a motor vehicle fuel for private and government fleets and develop the fueling infrastructure necessary to support these fleets.

OTHER FUELS

Fuels consumed in the transportation sector other than gasoline, diesel fuel, ethanol-blended fuels, and biodiesel include compressed natural gas, liquid petroleum gas (propane), and electricity. In recent years, Nebraska drivers have consumed 50,000 to 60,000 gallons of compressed natural gas and about one million gallons of propane on an annual basis. Currently, there are 2 compressed natural gas fueling stations, and 18 propane fueling stations.

According to the 2007 Nebraska Department of Motor Vehicles' Annual Report, there are 2,148,061 vehicles registered in the state. Of this total, an estimated 400 use compressed natural gas for fuel, 300 use propane, and 8 use electricity.

The use of alternative fuels allows Nebraska to continue its compliance with federal air quality standards. By consuming compressed natural gas, liquid petroleum gas (propane), and electricity, less pollution is emitted into the air than would be if conventional petroleum-based gasoline and diesel were consumed. Noise pollution can also be reduced with most alternative fuels.

Petroleum dependency and carbon dioxide emissions will be reduced by concentrating Nebraskans' efforts on decreasing the number of miles traveled, increasing vehicle efficiency, and increasing alternative fuel consumption.

GOAL

Encourage the use of E-10, E85, electricity, and compressed natural gas as a motor vehicle fuel for private and government fleets and develop the fueling infrastructure necessary to support these fleets.

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