

NEBRASKA

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DEPT. OF ENVIRONMENT AND ENERGY

Annual State Energy Report 2019



Letter from the Director



Dear Citizens of Nebraska:

On July 1, 2019, the Nebraska Energy Office and the Nebraska Department of Environmental Quality merged and became the Nebraska Department of Environment and Energy. There were many reasons why the effort to merge these agencies was initiated, most notably were the pursuit of administrative efficiencies and the ability to examine the challenges and opportunities that face our agencies in a more comprehensive manner.

It has only been a few months since the merger, but already there have been notable successes – the former Nebraska Energy Office staff have benefited from the administrative, fiscal, human resources and legal resources of the NDEQ. Conversely, NDEQ staff are examining NEO’s successes, particularly the Dollar and Energy Savings Loan program, to identify components that can be used in similar NDEQ programs.

The unprecedented floods and storms of 2019 presented all state agencies with significant challenges. Both staff from NDEQ and NEO answered those challenges in a combined manner. We were able to provide assistance to many individual home and business owners on matters related both the environment (primarily disposal issues) and energy-related matters. NDEE partnered with the Nebraska Department of Banking and Finance to establish a temporary low-interest loan (1%) category for energy-related repair and replacement projects. Staff from both NDEQ and NEO devoted considerable time in the field and were able to assist those impacted with cleanup and recovery efforts.

The nexus between energy and environment is multi-faceted and the issues that must be addressed are multi-dimensional. The merger of our agencies will better position NDEE to be successful. Statute requires NDEE to submit separate reports on environmental and energy issues. This report addresses the energy requirement.

Previous annual reports can be found on the agency’s website at:
<http://neo.ne.gov/info/pubs/pubs.html>.

Sincerely,

A handwritten signature in black ink, appearing to read "Jim Macy". The signature is fluid and cursive.

Jim Macy
Director

Nebraska Department of Environment and Energy

Annual Energy Report

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Vision, Mission and Core Values

With the merge between the Nebraska Energy Office and the Nebraska Department of Environmental Quality came the need to reexamine the team's vision, mission and core values.

Through an ongoing strategic planning process, The Nebraska Department of Environment and Energy's new vision is **everyone living, working and enjoying a healthy Nebraska Environment.**

To achieve this, our mission is to **protect and improve human health, the environment and energy resources.**

The agency's core values have been identified as:

- **Integrity,**
- **Excellence,**
- **Teamwork,**
- **Innovation, and**
- **Communication.**

Our new vision, mission and core values have always been in mind for the agency. But by actively planning, we have clear pathways toward protecting the state's energy and environmental resources.

The Programs

The Nebraska Department of Environment and Energy's Energy and Assistance Division operates several different annually-funded federal and state programs. These programs are:

- Weatherization Assistance
- State Energy Program and special projects
- Dollar and Energy Saving Loans
- State Heating Oil and Propane Program
- Statutorily-required state activities such as data collection and reporting.

An overview of the 2018-2019 fiscal activity appears at the end of this section. The period covered is July 1, 2018, to June 30, 2019, except where noted.

Weatherization Assistance Program

The Energy and Assistance Division (EAD) administers the federally funded program for weatherizing homes to save energy and money for those with limited incomes. The agency is responsible for inspecting the homes that are weatherized and for monitoring the sub-grantees, primarily community action agencies and one non-profit agency, that are responsible for the home weatherization improvements. Sub-grantee crews or private contractors are responsible for completing the work on the homes. The EAD staff inspects a minimum of 10-15% of all completed homes to ensure the quality of work performed.

The Weatherization Assistance Program received funding from two sources:

- \$2,600,000 from the Low-Income Home Energy Assistance Program (LIHEAP). Annually, the Nebraska Department of Health and Human Services transfers a portion of the funds they receive to the EAD, which is allocated to seven Community

Action Partnership Agencies and one non-profit agency to weatherize homes to reduce the energy burden for low-income Nebraskans. The EAD also received an additional \$500,000 from LIHEAP to use for Heating and Cooling Repair and Replacement. By putting this program under the Weatherization Assistance Program, the EAD is able to offer

428 Nebraska homes were weatherized through LIHEAP and the DOE in 2019.

an additional service where low-income people in Nebraska can repair or possibly replace their heating and cooling system.

- \$2,747,089 was received from the U.S. Department of Energy's Weatherization Assistance Program. More about both of these funds and how they have been spent throughout the state are in Figure 2. Between 2018-2019, 428 homes were

weatherized with these funds.

The types of improvements vary based on an energy audit analysis of the home and averages between \$5,000 and \$7,500 per home, excluding the cost of health and safety improvements such as furnace repairs. Prior to mid-2009, the average amount spent on homes ranged from \$2,500 to \$3,000. The average cost per home is set by the U.S. Department of Energy annually based on the Consumer Price Index (CPI). The kinds of improvements made to homes vary by the home type: frame, mobile or multi-family.

In homes, the most common improvements generally are:

- Adding insulation
- Replacing and repairing furnaces
- Reducing air leakage
- Installing high efficiency lighting
- Insulating water heater tanks and pipes
- Repairing cracked windows

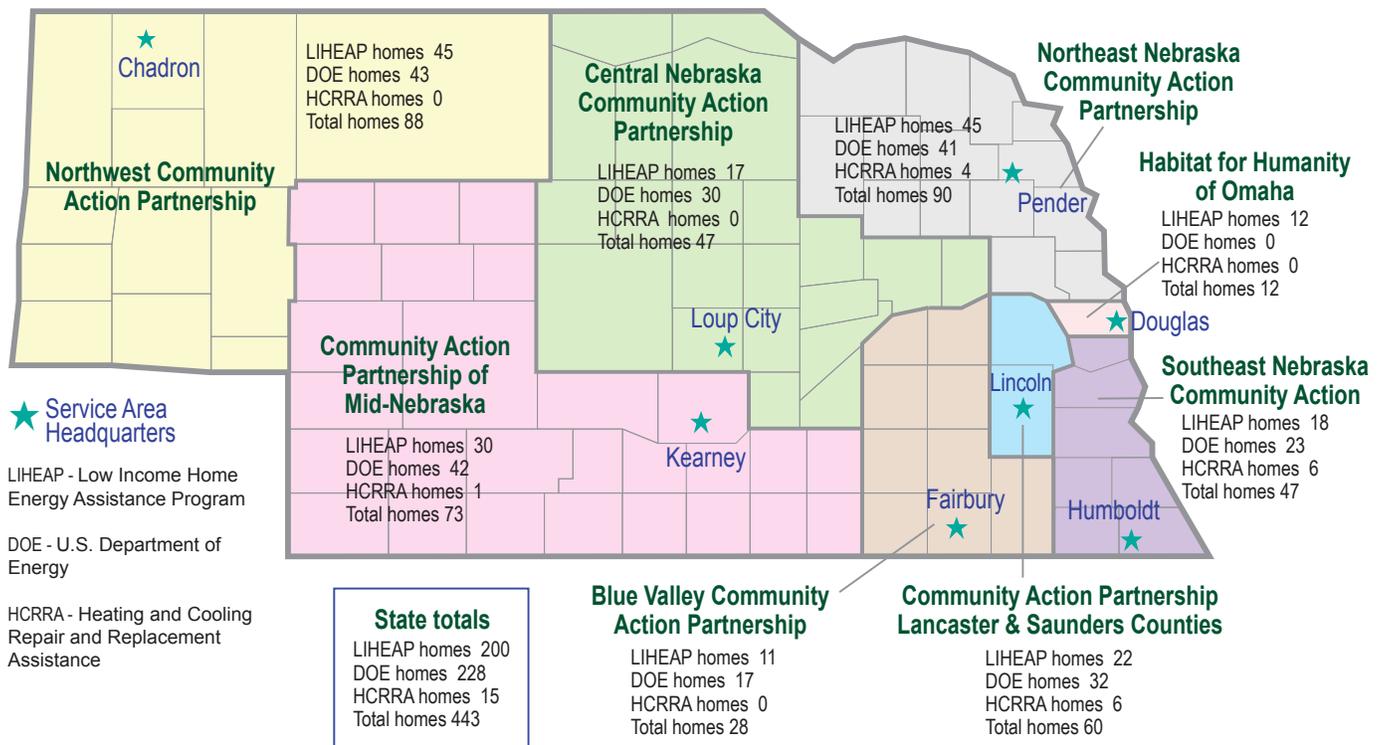
Since the Weatherization Assistance Program began in 1977, \$213 million has been spent to make energy efficiency improvements in 69,619 homes.

Energy and Assistance Division Investment in the Weatherization Assistance Program July 2018 - June 2019	
Investment (federal Funds)	\$1,076,526
Energy Impacts	
Electric Dollar Savings (present discounted value)	\$92,189
Natural Gas Dollar Savings (present discounted value)	\$362,148
Annual Total Dollar Savings	\$454,337
Present Discount Value of Future Savings	\$459,761
Economic Impacts	
Output	\$768,711
Value-Added	\$506,163
Labor Income	\$461,185
Job-Years	13.08
Air Emission Pollutant Reductions (Pounds)	
Carbon Dioxide (CO2)	6,160,688
Sulfur Dioxide (SO2)	7,795
Nitrogen Oxide (NOX)	8,022
Particulate Matter <2.5 micro-meters (PM2.5)	135.67
Volatile Organic Compounds (VOC)	299.74
Particulate Matter < 10 micro meters (PM10)	217.57

Source: NDEE

Figure 1

Total Nebraska Homes Weatherized by Area Providers July 2018 - June 2019



Source: NDEE

Figure 2

Dollar and Energy Saving Loans

The Dollar and Energy Saving Loan Program (DESL) was initially capitalized with Oil Overcharge Funds, later augmented with American Recovery and Reinvestment Act Funds and is continually recharged with loan repayments from borrowers.

The Department of Environment and Energy, in conjunction with over 200 eligible Nebraska lending institutions at more than 900 locations, continues to transform the energy market through access to statewide reduced interest rate loans. Energy efficiency, renewable energy and waste minimization projects in all sectors can be financed. Focus has been on homes, businesses and operating systems, alternative fuel vehicles, fueling facilities and equipment, wind and solar installations, telecommunications equipment, ENERGY STAR® certified home appliances and ENERGY STAR® five star plus homes. Interest rates ranged from 1% to 5% during 2018-2019, depending on the project eligible for financing, 2019 flood status and the lender. Additionally, schools willing to benchmark energy consumption through the life of the loan were offered 1% interest.

In March 2009, Nebraska Public Power District added \$500,000 – and provided a second \$500,000 in January 2010 – to the agency’s DESL Program to finance 1.5% loans for air source, ground water or ground coupled heat pumps,

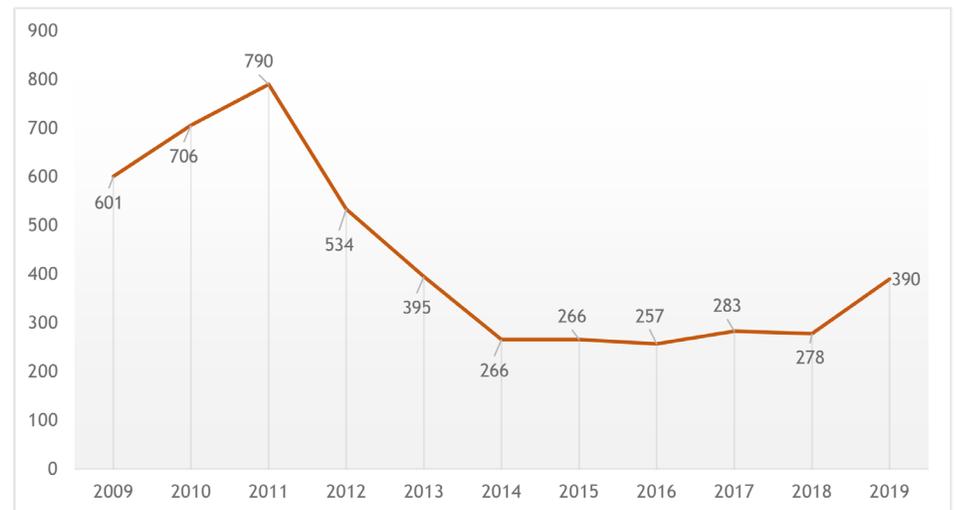
DESL Total Dollars Invested (millions of dollars) 2009-2019



Source: NDEE

Figure 3

DESL Number of Projects 2009-2019



Source: NDEE

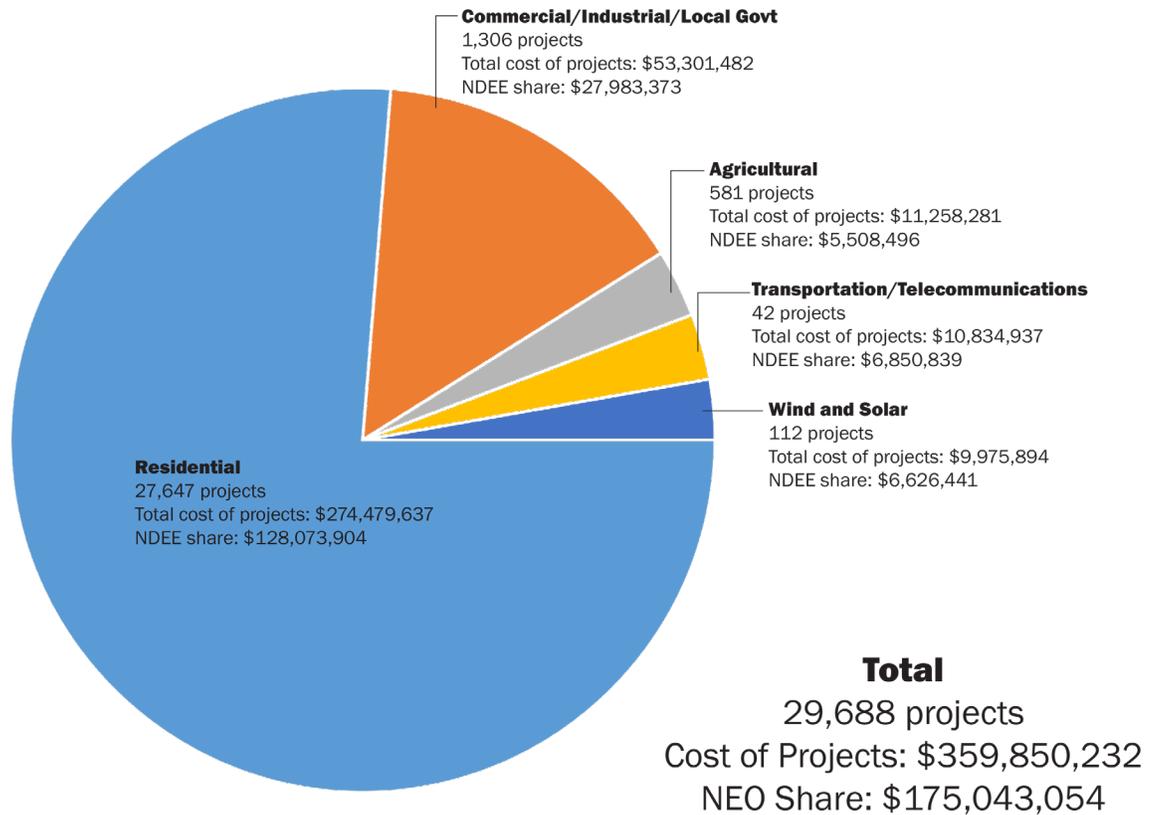
Figure 4

qualifying thermostats and back-up natural gas or propane furnaces with a 95 Annualized Fuel Utilization Efficiency (AFUE) rating or higher for the utility’s retail and wholesale customers. More information about these loans may be found at NDEE’s website, neo.ne.gov/programs/loans/loans.html.

From March 1990 to June 30, 2019, 29,688 energy saving

projects totaling more than \$359.9 million have been financed using low-interest loans from participating lenders and NDEE. More than \$176.8 million of the \$359.9 million has come from the agency’s revolving loan fund. The state’s participating lenders provided more than \$136.3 million. The balance, more than \$46.7 million, was spent by the borrowers for the

Total DESL Funds Invested by Project Category as of June 30, 2019



Source: NDEE

Figure 6

third-highest among all loans areas. Typical improvements in this category include dedicated alternative fueled vehicles, fueling equipment, alternative fuel facilities, network access equipment, video products and audio conferencing.

Wind, Solar and Fuel Cell Systems

3.79% of funds from all categories – \$9.98 million – has been used for 112 wind, solar and fuel systems projects since 1990, ranking fourth-highest among all loans areas. Typical improvements in this category include PV systems, solar hot water and wind.

Agricultural

Improvements in agricultural equipment and systems rank fifth in the use of low-interest

Residential Dollar and Energy Saving Loans July 2018 - June 2019	
Investment	\$3,715,154
Residential Projects	286
Energy Impacts	
Electric Energy Savings (kWhs)	88,231
Natural Gas Energy Savings (therms)	49,720
Present Discount Value of Future Savings	\$987,284
Present Day Value Economic Impacts	
Output	\$3,506,771
Value-Added	\$2,096,176
Labor Income	\$1,553,125
Job-Years	40
Air Emission Pollutant Reductions (Pounds All Years)	
Carbon Dioxide (CO2)	13,480,574
Sulfur Dioxide (SO2)	8,910
Nitrogen Oxide (NOX)	14,336
Particulate Matter <2.5 micro-meters (PM2.5)	154
Volatile Organic Compounds (VOC)	341
Particulate Matter < 10 micro-meters (PM1.0)	248
Total Present Discount Value of Environmental, Comfort, Health and Safety	\$863,122

Source: NDEE

Figure 7



This home in Greeley County received energy efficiency improvements on its doors and windows through the DESL program.

financing. More than 3.15% of all improvement funding — \$11.26 million — has been used to finance projects such as low-pressure irrigation systems, replacement of irrigation pumps and motors, replacement of grain dryers and well modifications. Since 1990, 581 projects have been financed with \$5.51 million from NDEE,

175 homes and businesses received \$2.65 million in DESL loans after 2019 flooding.

\$5.37 million from participating lenders and over \$383,000 from borrowers.

These efforts are complemented by NDEE's Clean Diesel Rebate Program, which provides rebates to replace diesel irrigation engines with all-electric equipment. This program, funded by grants from the U.S. Environmental Protection Agency, has completed 42 projects since 2017 with rebates totaling over \$589,000 and \$1.0 million from recipients.

Energy, Economic and Environmental Impacts

In 2012, a study analyzing the energy, economic and environmental impacts of Residential DESL was

completed by the University of Nebraska-Lincoln. Beginning January 2014, data from Residential DESL has been entered into the database. The energy, economic and environmental benefits of these loans from July 1, 2018, through June 30, 2019, are illustrated in Figure 7.

1% Loans for Flooding Assistance

Nebraska was impacted by unprecedented flooding in March and June of 2019. The Nebraska Department of Environment and Energy offered the DESL program at a reduced 1% interest rate to help Nebraskans affected by the flooding. Over 175 residential and commercial entities received loans for various energy efficiency projects. By June 30, applications totaling over \$1.9 million for 117 homes and businesses had been received, with \$106,156 issued in the 2018-2019 fiscal year. As of Jan. 22, 2019, over \$2.65 million in DESL funds were used to leverage over \$2.95 million in energy efficiency improvements. Windows, doors, foundations, insulation and heating and cooling systems could all be included in the 1% loans.



Flooding in March and June 2019 not only damaged roads, it also flooded buildings. NDEE made DESL program funds available at 1% interest to help Nebraskans get back on their feet while making businesses and homes more energy efficient. This picture was taken west of Columbus near Silver Creek.

State Energy Program Formula Grants

In 2018-2019, Nebraska received \$499,860 for this federally-funded effort and supplied \$99,972 in state funds from oil and natural gas severance taxes, as required 20% matching funds.

These funds are used to provide energy efficiency services to consumers and other small energy users, and include the publication of this Annual Report and the Nebraska Energy Quarterly as well as maintenance of the state's energy database (<http://neo.ne.gov/programs/stats/stats.html>) and agency website (neo.ne.gov).

These funds also provide program support for a wide array of activities that include energy supply shortage tracking and management and emergency preparedness, education and information, DESL operations, support of renewable energy activities and residential and commercial building energy efficiency activities.

Energy Codes Compliance Collaborative

The Energy Codes Compliance Collaborative was established in 2013 to help building owners and industry representatives monitor, evaluate and ensure compliance with the Nebraska Energy Code requirements. Collaborative members include representatives of state and local governments, homebuilders, utilities, architects, home energy

Nebraska was among the first states to adopt the 2018 International Energy Conservation Code.

raters, suppliers, banks and advocacy groups including Midwest Energy Efficiency Alliance and the Nebraska League of Municipalities. In 2019, Collaborative activities included:

- Collaboration with the Nebraska/Iowa/Illinois (Zone 5) National Commercial Buildings Energy Code Field Study,
- Working with the state's construction industry partners in their understanding of the cost and savings impacts associated with Nebraska's adoption of the 2018 International Energy Conservation Code and

- Assessing and reviewing other energy code compliance initiatives/projects in the Midwest region for beneficial replication in Nebraska.

Nebraska Wind and Solar Conference

Since 2008, the Nebraska Energy Office has partnered with many stakeholders interested in wind and solar energy to produce a state-wide Wind and Solar Conference. Agency staff members help develop and execute communications for the conference, including news release development, and distribution and social media promotion. NDEE Director Jim Macy opened this year's conference and was able to explain the benefits and ramifications of the merger of the Nebraska Energy Office and the Department of Environmental Quality to form the Department of Environment and Energy. Given the remarkable growth of both solar and wind energy generation in Nebraska, the conference is an ideal venue for NDEE staff to provide education and learn about solar and wind energy, and the interdependencies of all energy and environmental issues.

National Association of State Energy Officials

Participation in the National Association of State Energy Officials (NASEO) programs is also included in the State Energy Program. The agency participates in NASEO webinars and conference calls, and attends national and regional NASEO meetings and conferences concerning energy issues. Over the past year, NDEE staff have been active in panels associated with agricultural and rural issues and have presented on the collaborative efforts that preceded the successful adoption of the 2018 International Energy Conservation Code.

Nebraska Energy Efficiency Partnership

The Nebraska Energy Office was a founding member of the Nebraska Energy Efficiency Partnership (NEEP), which includes representatives

from Nebraska’s three largest electric utilities – Lincoln Electric System, Nebraska Public Power District and Omaha Public Power District—as well as the Municipal Energy Agency of Nebraska. NEEP meets to share knowledge, program ideas and other information related to making the most efficient use possible of Nebraska’s energy resources.

Because of the value that has come from NEEP meetings, a second, similar group is now forming – the Nebraska Solar and Storage Partnership. The development of solar energy and related storage, primarily batteries, is incredibly dynamic and keeping up with related developments will require a group effort.

State Energy Program Competitive Funding

Energy Reduction at Municipal Waste Water Plants

The Department of Environment and Energy collaborated with the University of Nebraska-Lincoln Department of Bio-Systems Engineering in a U.S. Department of Energy cooperative agreement addressing energy efficiency at local government waste water treatment facilities. The DOE awarded \$273,330 in December 2015 and it was matched with \$54,666 of state funds. The project concluded

NDEE and UNL hope to help municipal waste water plans find energy savings of 20% or better.

on June 30, 2019.

During the project energy use data from waste water plants in communities with a population of 10,000 or less was collected and evaluated. Further analysis was done to nearly 100 of the plants, which included on-site visits and data research. Technical assistance included a detailed energy audit report and was given to 27 of the lowest performing plants. The audit reports gave energy efficiency recommendations with the goal of achieving 20% or better of energy savings for each plant.

As a result of the study, the City of Atkinson invested \$484,317 using financing from the DESL program to install a 210 kw solar array at their wastewater treatment facility to reduce long-term operation costs.

Access Ethanol Nebraska

The Access Ethanol Nebraska (AEN) project was completed on Dec. 31, 2018. In our latest sales/



Fuel sites participating in Access Ethanol Nebraska reported dispensing 6,694,369 gallons of ethanol-blended fuels.

volume report for calendar year 2019, the 22 retail fuel sites participating in AEN reported dispensing 6,694,369 gallons of E15/E85 advanced blended fuels. This compares favorably to the 2018 figure of 3,971,923 gallons sold, or a 68.5% increase of 2,722,446 more gallons of advanced blend ethanol were distributed to the traveling public that year.

Nebraska Initiative Benchmarking and Beyond

In 2019, NDEE’s Energy and Assistance Division benchmarked 2,471 Nebraska state government buildings as part of the EPA’s ENERGY STAR Portfolio Management System. This accounts for 62% of the entire state’s listing of 3,818 properties as of 2015 for 12 state agencies.

In addition with Nebraska Initiative Benchmarking and Beyond's partnership with the University of Nebraska Omaha (UNO), a benchmarking curriculum for both middle and high school students was completed in 2019 and is now being piloted in Lincoln Public Schools.

2019 tasks for this award included:

- Completed Building Operator Certification training for nine state facility managers at University of Nebraska Kearney,

- Revised NEO's Energy, Economic and Environmental Impact Tool to analyze public/commercial buildings by the University of Nebraska-Lincoln Bureau of Business Research,

- Completed one additional Benchmarking training for university interns and two state facility managers, and

- Developed recommendations to encourage future state benchmarking efforts.

State Heating Oil and Propane Program

Between September 2018 and September 2019, the Nebraska Energy Office began its 17th year of participation in the U.S. Department of Energy's State Heating Oil and Propane Program.

For this program, staff collected price information October through March from a sampling of Nebraska suppliers. (The sampling of Nebraska suppliers was selected by the DOE's Energy Information Administration.) The price information was shared

with the EIA and then posted on the Nebraska Department of Environment and Energy's website (www.neo.ne.gov/programs/stats/inf/86.html and www.neo.ne.gov/programs/stats/inf/87.html).

The DOE provided a grant of \$6,291 for this program, which was required to be matched one-for-one using state cash funds. By the end of the reporting period, all funds were expended and the project was completed.

Oil Overcharge Funds

Beginning in 1982, Nebraska received oil overcharge — or petroleum violation escrow — funds as a result of several court actions against oil companies that overcharged their customers during the period of federal price controls from 1973 to 1981. Since direct restitution to injured consumers was not practical, the courts ordered the money be distributed to the states and used, within parameters established by the courts and a federal regulator, to fund energy assistance and efficiency programs.

These funds were used for several purposes throughout NEO, most notably, the funds

Nebraska Energy Settlement Fund Summary of Exxon, Stripper Well and Diamond Shamrock Oil Overcharge Funds as of June 30, 2019				
	Exxon	Stripper Well	Diamond Shamrock	Total
Funds Received	\$15,504,944	\$15,680,564	\$359,172	\$31,544,680
Interest Earned and Miscellaneous Income	\$13,093,345	\$11,656,630	\$262,689	\$25,012,664
Total	\$28,598,289	\$27,337,194	\$621,861	\$56,557,344
Funds Budgeted	\$28,598,289	\$26,930,791	\$621,861	\$56,150,941
Low Income Designated		\$17,675		\$17,675
Uncommitted Balance		\$388,728		\$388,728

Source: NDEE

Figure 8

helped create the DESL program.

The final petroleum violation escrow payment from the U.S. Department of Energy to the Energy Office was received March 28, 2017.

The Legislature and the U.S. Department of Energy require the Energy Office to annually report

on the disposition of these funds.

This report, specifically the DESL explanation above and figure 8, fulfill the reporting requirement.

A Nebraska Energy Settlement Fund Summary of activities and expenditures is detailed in Figure 8.

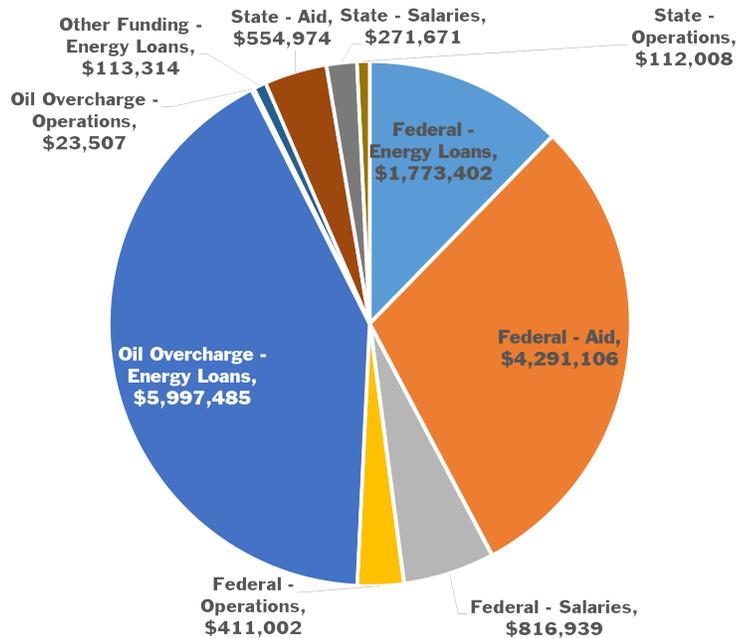
Financial Activity

Total EAD expenditures for the year were \$14,365,408, an increase of 26.8%. Energy loans accounted for 54.9% of expenditures, aid payments accounted for 33.7% and the remaining 11.4% of expenditures were for salaries and operations.

Of the funding for these expenditures, 41.9% came from the Oil Overcharge Funds, 50.8% from federal funds and 7.3% from state and other funds.

A complete listing of expenditures by funding source and category is illustrated in Figure 10.

How Funds Were Spent by Source July 1, 2018 – June 30, 2019



Source: NDEE

Total: \$14,365,408

Figure 9

Nebraska Energy Trends and Needs

Statewide Energy

Demand

According to the Energy Information Administration (EIA), Nebraska's total energy consumption in 2017 was 876 trillion British thermal units (Btu), an increase of 7.7 trillion Btu – or 0.9% – from 2016 to 2017. (A Btu is a standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level.) Data referred to or included in the figures reflect the most current data available at the time of publication.

Five types of energy sources comprised the energy that Nebraska consumed in 2017 as seen in Figure 10:

- Petroleum (and products) - 26.3%,
 - Coal - 25.8%,
 - Renewable energy - 20.5%,
 - Natural gas - 19.4%, and
 - Nuclear power - 8%.
- From 2016 to 2017, the use of natural gas and

renewable energy increased, while the use of petroleum, nuclear power and coal decreased.

Nebraska is the only state that generates electricity entirely by publicly owned power systems. According to EIA, as of 2018, the statewide average electricity price is the 16th-lowest rate in the country at 9.02 cents per kWh, based on the latest federal figures.

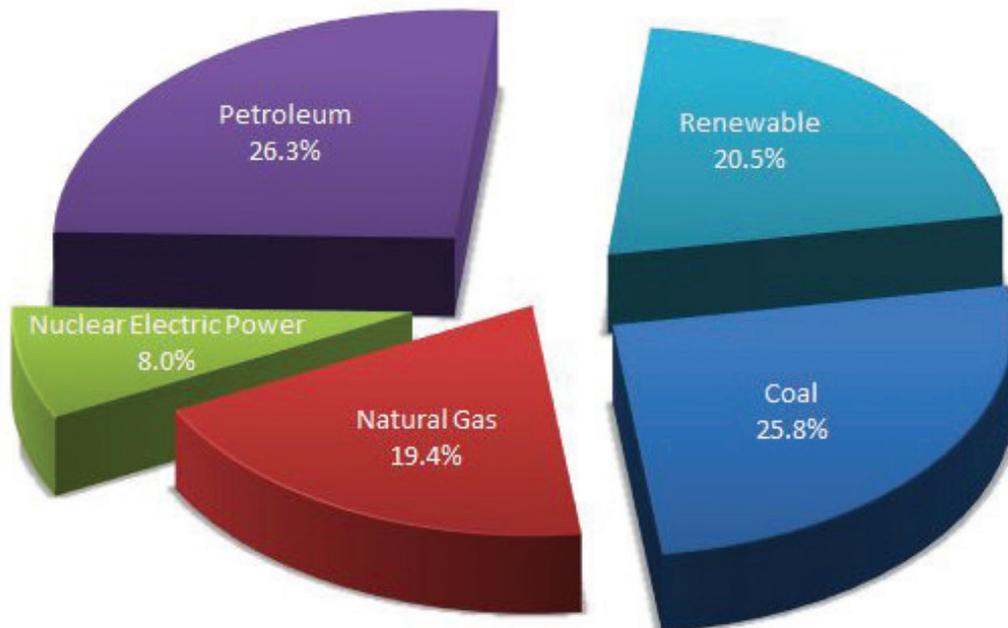
Coal use is now on the decline as more efforts are made to rely on carbon-free sources of energy.

Resource Assessment

State Energy Consumption Over Time

The EIA has collected data on energy consumption since 1960. As shown in Figure 11, energy use over the past 57 years has changed

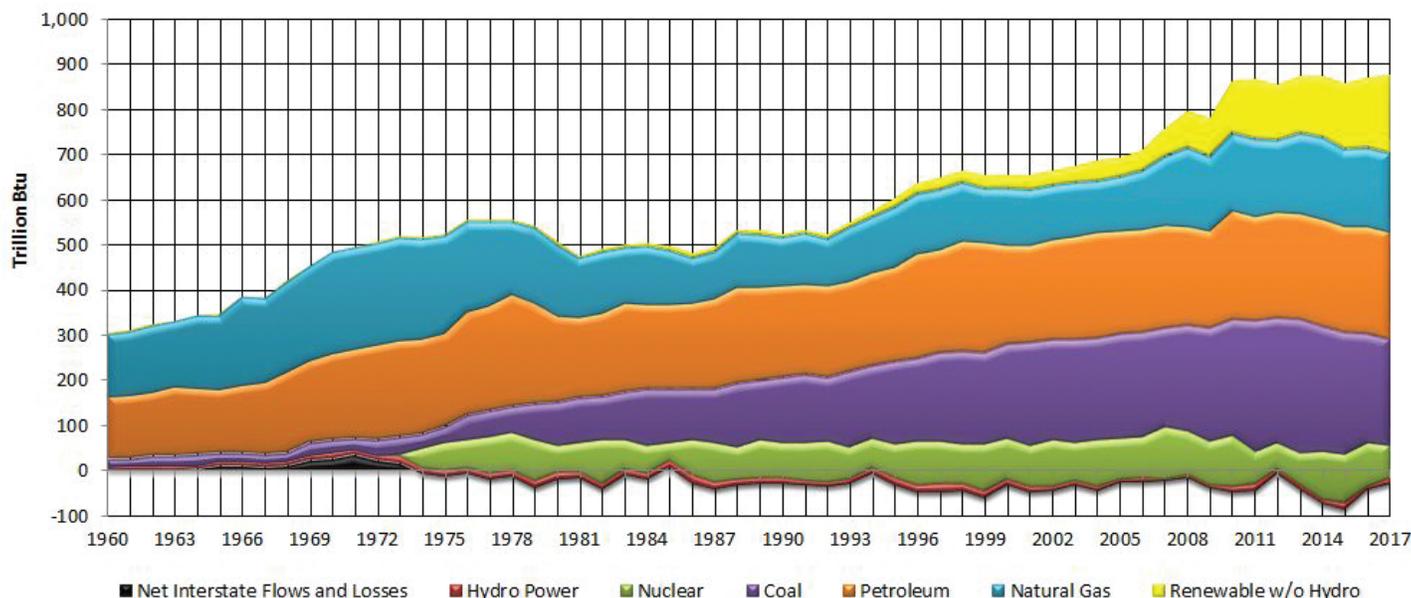
Total Energy Consumption by Fuel Type
Nebraska, 2017



Source: NDEE

Figure 10

Total Energy Consumption by Fuel Type Nebraska, 1960 - 2017



Source: NDEE

Figure 11

markedly. Overall, total energy consumption has nearly tripled from 308 trillion Btu in 1960 to 876 trillion Btu in 2017. The first notable change after 1960 was coal use, which increased eleven-fold from 20 trillion Btu to 233.8 trillion Btu. Peak use of coal occurred in 2013, when it reached 292.96 trillion Btu. Virtually all of this growth is due to the generation of electricity. Coal use is now on the decline as more efforts are made to rely on carbon-free sources of energy. Nebraska's public power system continues to provide electricity from all sources of energy at economical rates.

Natural gas consumption has varied through the years. Overall, it has grown from 140.4 trillion Btu in 1960 to 175.6 trillion Btu in 2017. Natural gas consumption peaked in 1973 at 230.8 trillion Btu. The variation in consumption of natural gas is, in part, a result of increased equipment efficiency, electric utilities using natural gas for peak power production, and greater availability and use by the industrial sector.

Petroleum product use is another notable change. It nearly doubled over the past 57 years from 136.0 trillion Btu in 1960 to 238.2 trillion Btu in 2017. Gasoline and distillate fuel oil – primarily diesel fuel – comprise the bulk of refined petroleum products consumed. Both types of refined petroleum products increased between 1960 and 2017. Gasoline increased by 22.8 trillion

Btu, and diesel fuel increased by 87.2 trillion Btu – nearly a five-fold increase.

Diesel fuel consumption more than quadrupled from 24.2 trillion Btu in 1960 to 111.4 trillion Btu in 2017.

Gasoline consumption increased from 78.8 trillion Btu in 1960 to 101.6 trillion Btu in 2017. Gasoline consumption peaked in 1978 at 116.0 trillion Btu. Changes in gasoline consumption can be traced primarily to improved fuel efficiency of vehicles. Motor vehicle miles traveled increased from 12 billion miles a year in 1978 to 21.01 billion miles a year in 2017, continuing peak rises every year since 2012, according to the Department of Transportation. Overall, petroleum consumption peaked in 1978 at 246.4 trillion Btu.

The last change of note is the use of nuclear power. Nuclear power was first generated in 1973. Nuclear consumption has increased significantly, rising from 6.5 trillion Btu in 1973 to 72.3 trillion Btu in 2017. Nuclear consumption peaked in 2007 at 115.8 trillion Btu. However, figures will change as OPPD's Fort Calhoun Nuclear Station, a 478 MW power plant, was shut down on Oct. 24, 2016.

Feasible Alternative Energy Sources

Renewable energy consumption grew from 13.4 trillion Btu in 1960 to 185.6 trillion Btu in 2017. Energy production from renewables peaked

in 2017. Between 1960 and 1994, the primary renewable energy source was hydropower.

In 1995, biofuel – ethanol – achieved equity with hydropower. By 2000, biofuel production was double the amount of hydropower produced. In 2017, the total amount of renewable energy produced included:

- Biofuels - 64.4%;
- Wind - 25.2%;
- Hydroelectric power - 7.4%; and
- Wood and wood waste - 2.1%.

Minor amounts came from geothermal and solar.

OPPD has contracts to buy wind power from several Nebraska wind farms. In 2019, OPPD added 160 megawatts (MW) of additional wind power from the Sholes windfarm near Wayne, which will bring OPPD’s energy from renewables to 40%. OPPD has signed power purchase contracts for 1,000 MW of wind energy and is seeking bids for 400 to 600 MW of solar power. OPPD also has a five MW Community Solar Program, where citizens in the community could buy shares of a solar farm near Fort Calhoun. OPPD customers took advantage of the program and the 8,400 shares sold out quickly.

Wind and solar are not the only changes coming to Nebraska electricity generation. A different kind of change is coming to the 225 MW coal-fired Sheldon power plant owned and operated by the Nebraska Public Power District (NPPD) near Hallam – Monolith Materials, a manufacturing company, is co-locating a carbon black factory there. Carbon black is used to make automobile tires, various rubber products, and laserjet toner, among other things. While this product is normally made using highly polluting oil or coal-tar, Monolith will convert natural gas into carbon black with hydrogen being a byproduct. NPPD will convert one coal unit at the Sheldon station to burn the hydrogen as a clean source of electricity. This will be the first new carbon black factory in the U.S. in more than 30 years, and will be the largest hydrogen-fired power plant in the U.S.

NPPD is also exploring producing methanol from hydrogen and carbon dioxide; the methanol would be used to produce electricity. The project is in early stages of development and serves as an example of NPPD’s and public power’s willingness to examine emerging technologies.

Agricultural Sector

Agriculture is Nebraska’s number one industry. For purposes of the annual report, it is important to examine the agricultural sector individually. It should be noted that the EIA statistics combine agriculture into the broad industrial category. In addition to the agricultural information extracted from EIA, NDEE also utilized USDA information, particularly the Census of Agriculture and information provided by the National Agricultural Statistics Service.

In 2017, the USDA estimated that nearly 9% of total cash production expenses for agriculture were for energy, directly or indirectly. Farm energy consumption has fallen 26% as farm output has increased 63%. There are many factors that contribute to the increase in agricultural productivity, the wise use of energy resources, e.g. reduced or no-till farming, is certainly among them.

Energy Supply

Energy supply needs for the state’s agricultural sector have been met. Over the years, energy supply problems have been limited to infrequent shortfalls

of petroleum products due to transportation issues. For example, the bomb cyclone of 2019 damaged many bridges and disrupted fuel supplies to rural areas. Similarly, in 2019 there was a temporary interruption in propane supply due to lack of supporting infrastructure in Iowa. High demand for propane in Iowa for drying high-moisture corn taxed the propane delivery system. While there was sufficient supply at the national level, not enough propane could be delivered to Iowa. This resulted in Iowa producers traveling to adjacent states,

Biofuels, particularly ethanol, have and will continue to significantly decrease the nation’s reliance on foreign sources of energy for our transportation needs.

including Nebraska, for propane supplies.

The transportation issue is not limited to petroleum products. Electric transmission is vital to Nebraska’s agricultural sector. While Nebraska has

sufficient electric generation capacity, there are times when the transmission system is taxed. This is most often evident in times of natural disasters when storms destroy parts of the transmission system. Unusually high demand in local areas can also cause problems. In 2012, record drought, along with electrical demand for irrigation in north-central Nebraska, taxed the NPPD transmission system. To ensure their customers were provided reliable electrical supply to run irrigation engines, NPPD had to locate mobile diesel generation units to meet demand. To ensure continued reliability in north-central Nebraska, NPPD has initiated a number of related transmission system upgrades.

The agriculture sector represents an existing and potential source of energy for Nebraska. Biofuels, particularly ethanol, have and will continue to significantly decrease the nation's reliance on foreign sources of energy for our transportation needs. Ethanol optimizes the golden triangle of renewable energy, crops and animal agriculture. A bushel of corn produces not only ethanol, but distiller's grain, a high protein feed for cattle. In 2018, 38.7% of Nebraska's corn crop (670 million bushels) was used by the state's 25 ethanol plants to produce 2.1 billion gallons of ethanol. Ethanol consumption in Nebraska totaled 81.4 million gallons in 2018. Additionally, more than 6 million tons of distiller's grain was produced.

A largely untapped source of energy exists in Nebraska's livestock industry. The University of Nebraska, the former NDEQ and NEO examined the state's cattle, pork, dairy and poultry industries in 2011. That examination led to an estimate that Nebraska's combined livestock operations could produce enough renewable natural gas (methane) to generate 95.4 Megawatts (MW) of electricity – enough to provide electricity for 8% of the households in the state – or produce renewable natural gas equivalent to 41.9 million gallons of gasoline - enough for 78,500 vehicles on an annual

basis. These are potential figures and there are a number of challenges to capturing the renewable natural gas from livestock operations, primarily the initial capital costs of constructing the facilities. To date, only O'Lean Energy, associated with an 8,000-head pork facility in Colfax County, has established a renewable natural gas capture and use facility on a confined animal feeding operation.

Demand

Energy needs in the agricultural sector are influenced by the cost of inputs, which are a significant factor in modern farming. Over the decades, farms have increased in size and energy has replaced labor, allowing fewer people to produce larger harvests of agricultural goods.

There has been an increase in irrigation across the state over the past several decades. In 1966, 3.1 million acres were irrigated, and by 2017, 8.6 million acres were under irrigation. In 2007, Nebraska became the state with the most acres under irrigation. The availability of irrigation has contributed to the growth of the ethanol industry in Nebraska. Corn requires 10 inches of evapotranspiration to produce the first bushel – the highest of all the crops grown in the state. As a result, any rainfall shortage is made up with irrigation, which requires an energy input. According to the latest USDA National Agricultural Statistics Service Farm and Ranch Irrigation Survey, the fuel used to power irrigation pumps was diverse:

- electricity, 55%;
- diesel, 26%;
- natural gas, 10%;
- propane, 7% and
- gasoline/ethanol, 0.2%.

The decline in the use of natural gas, diesel and propane has led to nearly a 10% increase in electricity.

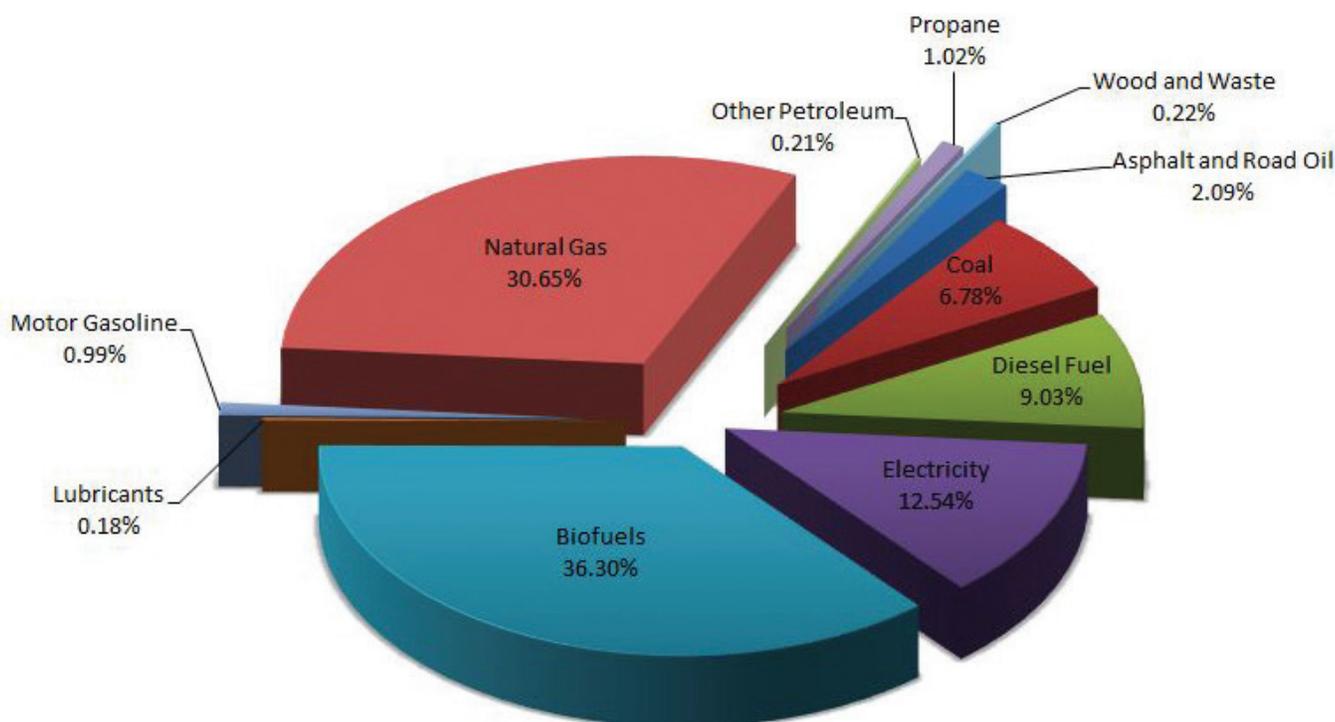
Industrial Sector

The industrial sector includes manufacturing, construction, mining, forestry and agricultural operations. As previously indicated, there is overlap between the agricultural sector and the industrial sector due to the EIA including

agricultural activities in the industrial sector.

This sector relies on more diverse fuel types than the other sectors of the economy. Coal, electricity, natural gas, renewable energy and a variety of petroleum products are the fuel types utilized in industrial sector operations.

Net Energy Consumption by Fuel Type Industrial Sector, Nebraska, 2017



Source: NDEE

Figure 12

Energy Supply

As shown in Figure 12, nearly all of the industrial sector's energy needs in 2017 were met by biofuels, coal, electricity, natural gas and petroleum products. Petroleum products include diesel fuel, asphalt and road oil, propane, lubricants and

Trends in fuel types used in the industrial sector illustrate the dynamic needs of this sector.

motor gasoline. Supplies of these fuel types have been readily available to industrial users.

Trends in fuel types used in the industrial sector illustrate the dynamic needs of this sector and how industries can switch fuel types over time. The emergence of industries such as ethanol plants and data centers can also alter fuel use patterns.

Natural gas use in 1960 was 38.27 trillion Btu and soared in 1973 to 73.73 trillion Btu. Subsequent energy price spikes and other factors reduced natural gas consumption to 20.31 trillion Btu by

1986. Natural gas use has fluctuated considerably since then, and a new historical peak occurred in 2016 at 96.47 trillion Btu.

Consumption of diesel fuel doubled from 1960 to 2017, rising from 14.01 trillion Btu to 27.99 trillion Btu. Gasoline consumption dropped by nearly 73% between 1960 and 2017, from 11.27 trillion Btu in 1960 to 3.07 trillion Btu in 2017. Looking at Figure 13, the growing use of electricity in this sector is demonstrated by the nearly thirteen-fold increase from 3.03 trillion Btu in 1960 to 38.89 in 2017.

Demand

The industrial sector made up 45% (392.4 trillion Btu) of the state's energy consumption in 2017. The increase in industrial sector energy consumption was 4.5% from 2016 to 2017.

In 1960, the industrial sector used 92.9 trillion Btu and was the second largest energy user after transportation, which used 94.2 trillion Btu. Industrial sector energy consumption surpassed the transportation sector in 1994. By 2017, the industrial sector was the largest energy-using sector at 392.4 trillion Btu, surpassing the

transportation sector by 190.1 trillion Btu.

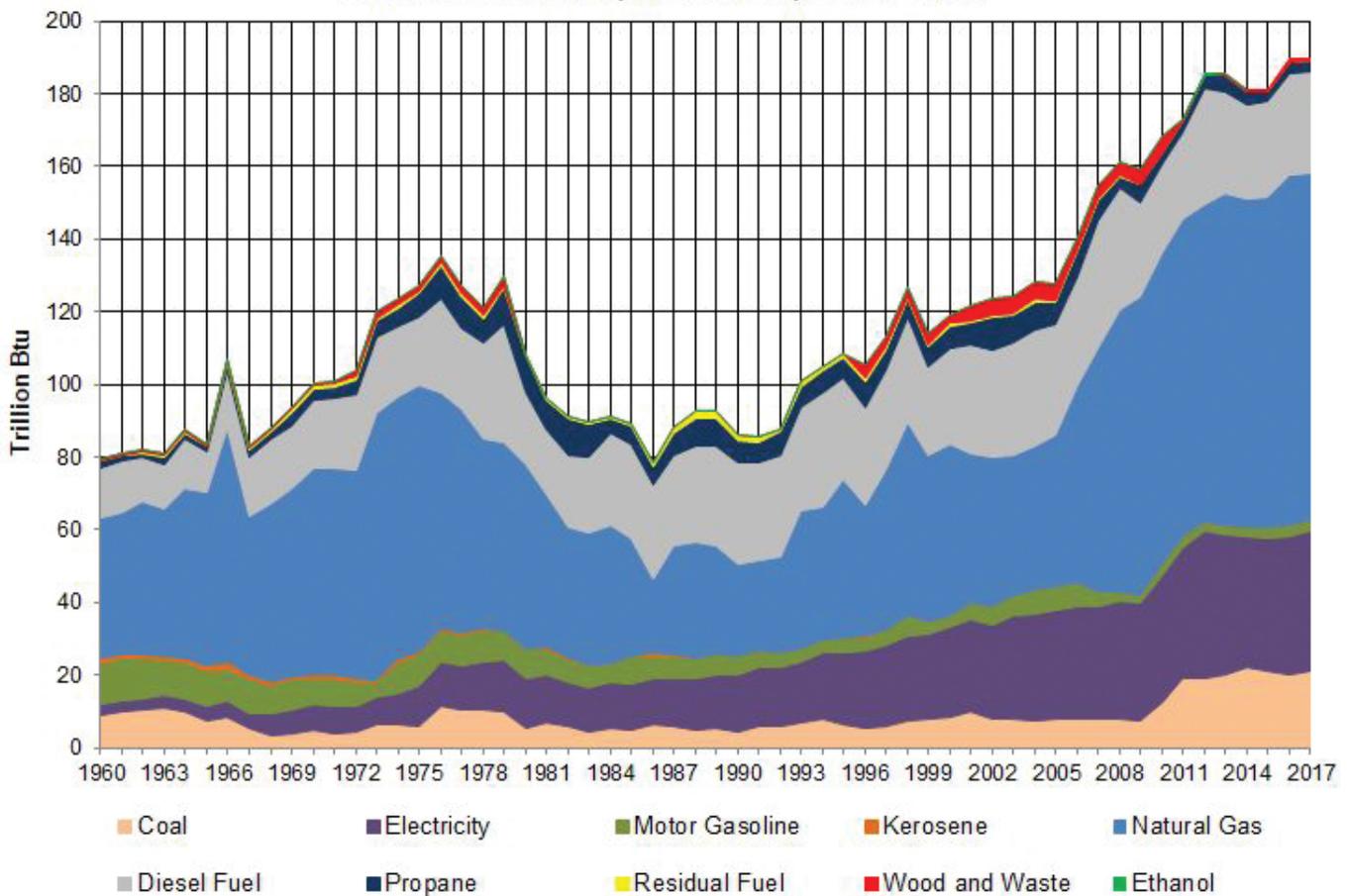
The Facebook data center in Papillion went online in June 2019. A primary reason Facebook located in Nebraska was the state’s reliable supply of renewable energy. Facebook has committed to using 100% renewable energy and is buying wind power from OPPD.

Google has purchased only renewable energy since 2017 and is building a \$600 million data center in Papillion that will join seven other data centers in Sarpy County. The Google data center will require the equivalent of 100,000 households worth of power which OPPD will be able to accommodate with wind power. Sarpy County also is home to data centers run by Fidelity Investments, Travelers Insurance and Yahoo (now owned by Oath). Nebraska offered a site that was

primed to provide a reliable source of electricity for these data centers.

Overall, energy needs in the industrial sector are subject to the ebb and flow of the business cycle. National, regional and local economic trends can also cause spikes or reductions in energy needs and demands. For example, the surge in ethanol production in the state added to the industry sector’s energy needs for electricity and natural gas. The rise of ethanol production in Nebraska also caused growth in the renewable energy category, specifically ethanol and ethanol coproducts. It should be noted that ethanol can lower the carbon footprint compared to gasoline which makes it a more favorable fuel in meeting Low-Carbon Fuel Standards in locations such as California.

**Energy Consumption by Fuel Type
Industrial Sector, Nebraska, 1960 - 2017**



Source: NDEE

Figure 13

Commercial Sector

The commercial sector, which includes non-manufacturing business establishments, closely parallels residential energy use and economic activity in the state. Energy use by local, state and federal governments is also included in this sector.

Energy Supply

More than 90% of all fuel used in the commercial sector was supplied by natural gas and electricity in 2017 (Figure 14). Supplies of both types of energy have been sufficient to meet this sector's needs. The only disruptions have been because of temporary weather-related electric transmission issues.

Although natural gas and electricity remain the top two fuel types used in the commercial sector,

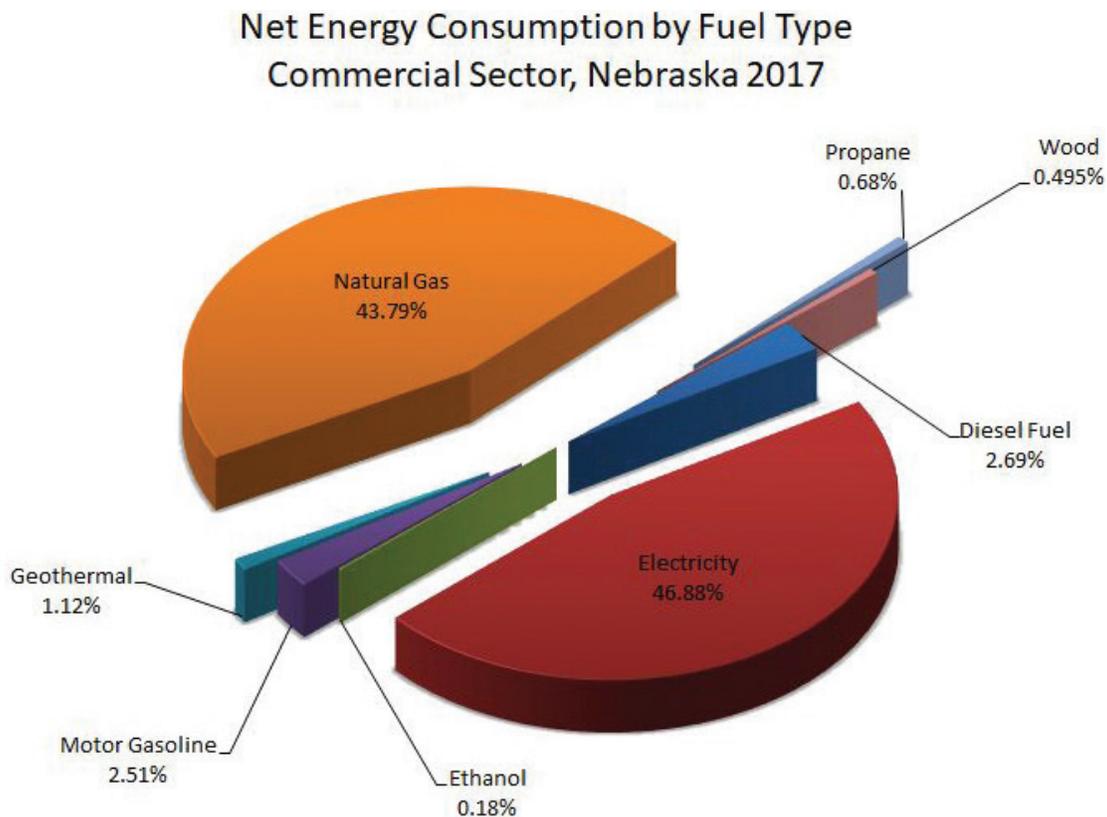
trends indicate the supply of the two are becoming equal (see Figure 14).

Demand

According to the EIA, in 2017 135.2 trillion Btu of energy were consumed in the sector, up 0.7 trillion (0.5%) Btu from 2016.

Figure 15 shows when data collection began in 1960, the commercial sector demand was 42.1 trillion Btu. The amount of energy used in this sector tripled to 135.2 trillion Btu in 2017. Energy use peaked for the commercial sector in 2008, when consumption reached 145.8 trillion Btu.

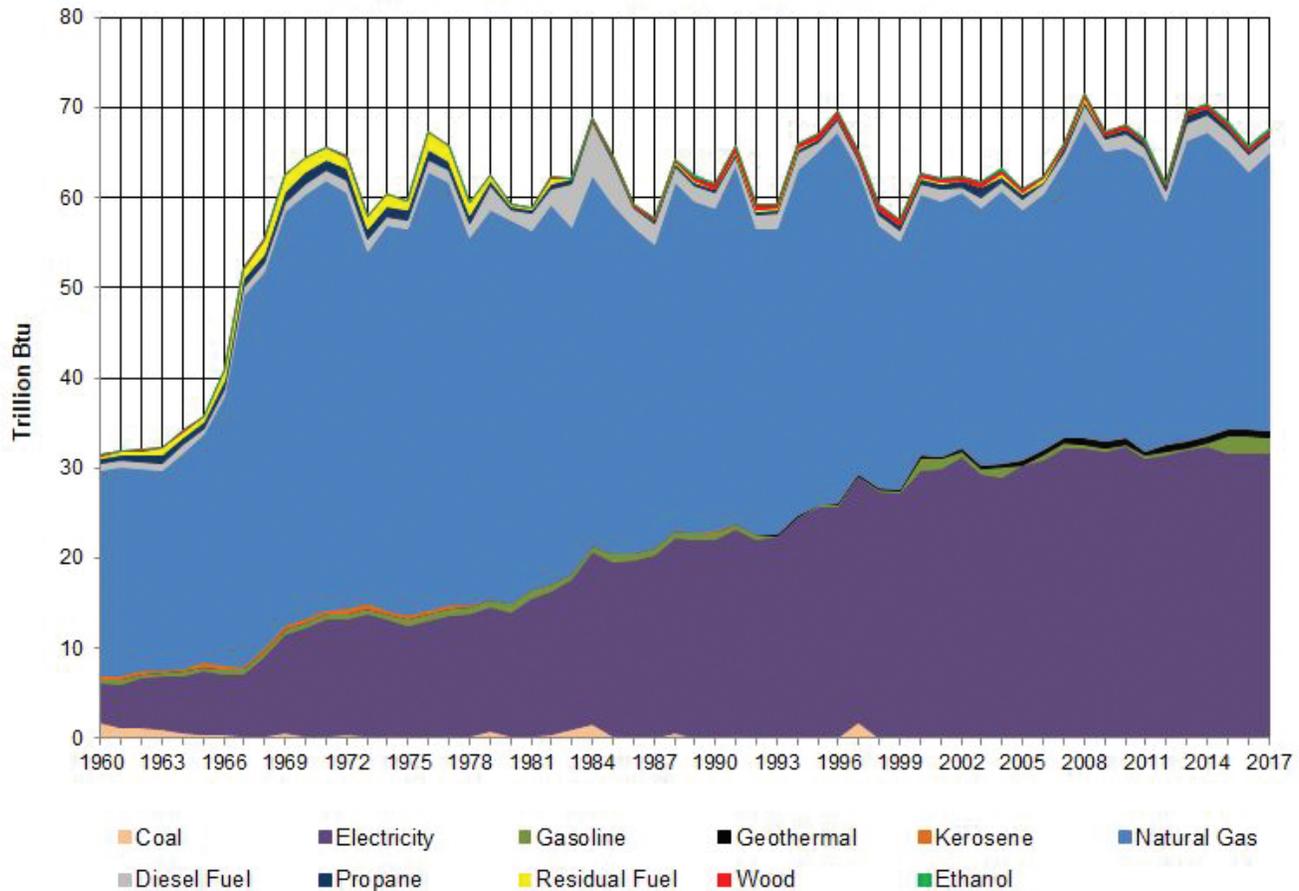
Because the primary needs of the commercial sector are confined to readily available supplies of natural gas and electricity, no issues relating to energy need are foreseen because supplies of both fuel types are ample.



Source: NDEE

Figure 14

Energy Consumption by Fuel Type Commercial Sector, Nebraska, 1960 - 2017



Source: NDEE

Figure 15

Residential Sector

Residential energy is primarily used for home heating and air conditioning, water heating, refrigeration, cooking, clothes drying and lighting. Electricity service is available statewide, and natural gas service is available to a majority of the state's residents. However, information from the Natural Gas and Pipeline Department of the Nebraska Public Service Commission indicates there are about 210 small communities (villages and cities with populations of less than 2,800) that do not have natural gas service because of lack of infrastructure. These communities make up 35.8% of the 586 communities in the state.

Unlike Nebraska's electrical system, natural gas supplies are not available statewide. Increased availability of natural gas could benefit homes as well as commercial and industrial operations.

Energy Supply

As shown in Figure 16, in 2017 the residential

sector's energy needs were met by:

- Natural gas, 47%;
- Electricity, 43.3%;
- Petroleum, 6.1%; and
- Renewable energy, 3.1%.

Supply trends and fuel types used in the residential sector have not changed substantially over 57 years of data collection. It should be noted that the NDEE Dollar and Energy Saving Loans (DESL) program can provide low-interest loans for renewable energy supplies for homes as well as businesses. In 2018-19 the DESL program provided \$506,975 dollars in loans for solar systems in residences across the state.

Demand

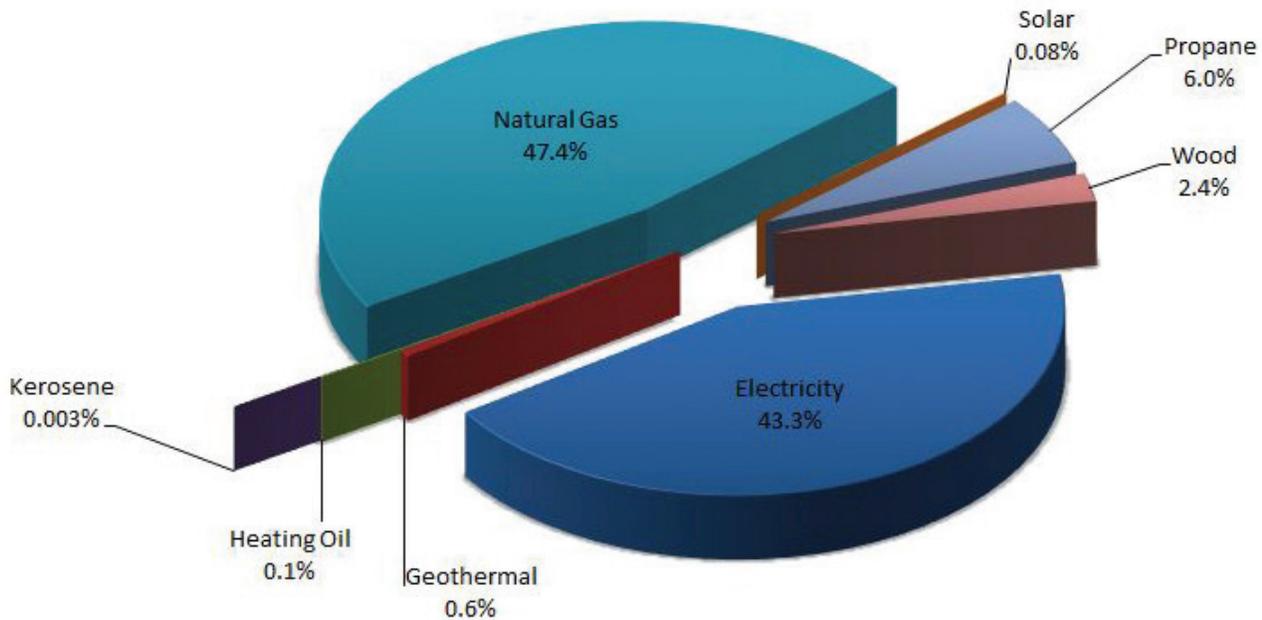
In 2017, 17% of the state's total energy demand was consumed in the residential sector. That same year, demand decreased by 1.5% from 148.3 trillion Btu in 2016 to 146.2 trillion Btu. Natural gas use increased 3.3% from 2016, petroleum use decreased 7%, electricity use decreased 0.7%, and renewable energy

use decreased 14.3% from 2016. Figure 17 provides a visual of this energy use decline.

How and how much this sector uses energy has changed over 57 years. In 1960, electricity use totaled 6.51 trillion Btu, but by 2017, electricity demand totaled 32.99 trillion Btu, a five-fold increase. Natural

gas demand was 40.88 trillion Btu in 1960, peaked at 60.86 trillion Btu in 1972 and generally declined by about a third until recently. Propane demand in 1960 was 7.50 trillion Btu, and was almost cut in half in 2017, with demand at 4.56 trillion Btu.

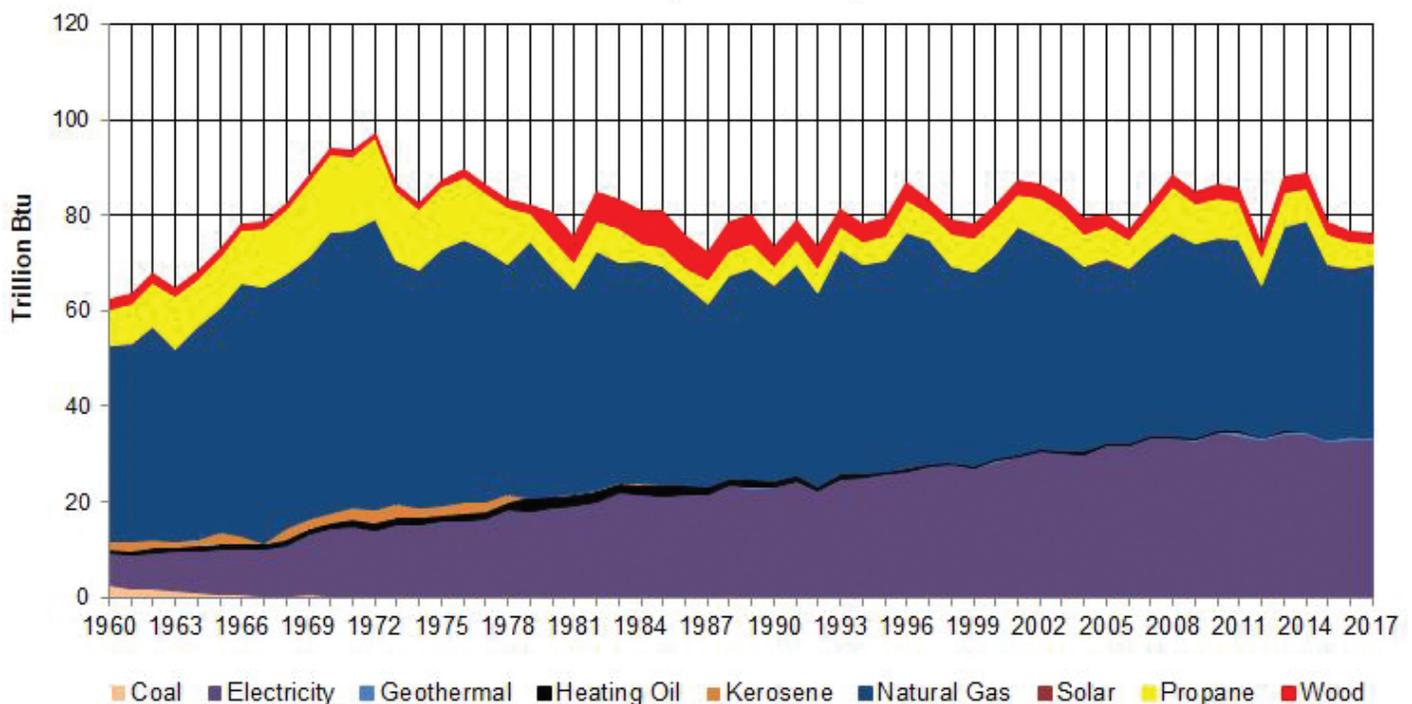
Net Energy Consumption by Fuel Type Residential Sector, Nebraska, 2017



Source: NDEE

Figure 16

Energy Consumption by Fuel Type Residential Sector, Nebraska, 1960 - 2017



Source: NDEE

Figure 17

Transportation Sector

Traditional methods of transportation such as public and private vehicles, railroads and aircraft are included in the transportation sector, as well as energy used to transport oil and natural gas through pipelines. Transportation is a challenge in Nebraska, the nation's 16th-largest state by area; long distances between locations contribute to the energy demands in the transportation sector, accounting for 23% of Nebraska's total energy demand in 2017.

Energy Supply

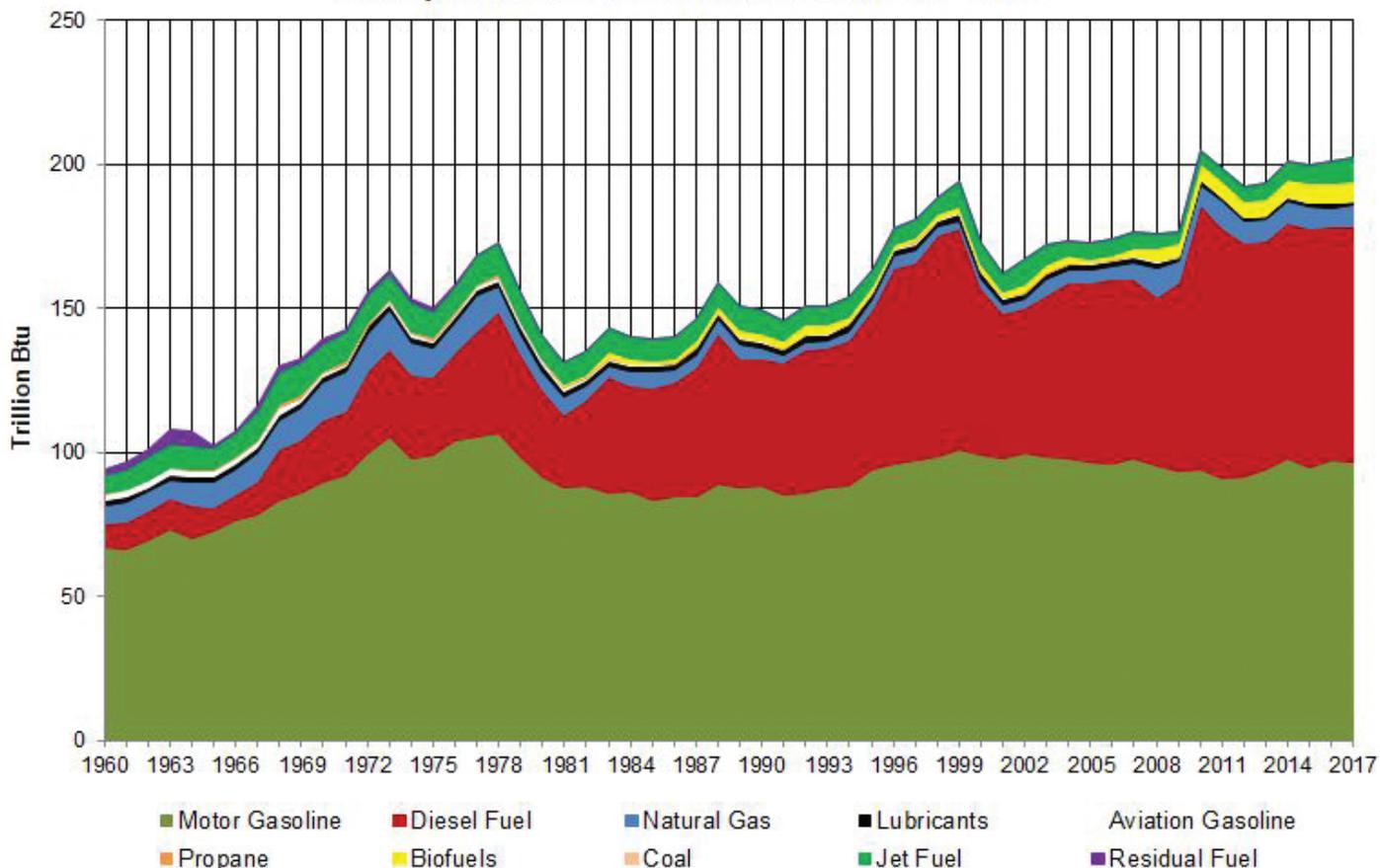
In 2017, 93% of energy used in transportation – 187.59 trillion Btu – was in the form of petroleum products, primarily diesel fuel and gasoline. The next two fuel types used of any consequence were natural gas at 7.84 trillion Btu and biofuels at 6.83 trillion Btu.

Generally, supplies of these fuel types have been readily available to transportation users.

As shown in Figure 18, trends in fuel types used in the transportation sector illustrate the static nature of this sector and how modes of transportation have changed little since record-keeping began in 1960.

The transportation sector was nearly totally dependent on petroleum-based fuels in 1960, and remained just as dependent in 2017. The changes that occurred in the 57-year period primarily related to increased fuel use. Renewable fuel use, specifically ethanol, began in 1981 at 0.27 trillion Btu and hit a new historical peak of 6.83 trillion Btu in 2017. Ethanol use in 2017 increased by 0.9%, or 0.06 trillion Btu, over 2016. Diesel fuel use in 1960 was 8.17 trillion Btu, rose to 58.43 trillion Btu in 2008, and peaked at 91.416 trillion Btu in 2010. Diesel fuel use increased in 2017 to 81.39 trillion Btu from 80.94 trillion Btu in 2016. Motor gasoline use in 1960 was 67.07 trillion Btu, peaked in 1978 at 106.78 trillion Btu, declined by 1985 to 83.59 trillion Btu, and started to rise again in 1995 to 94.49 trillion Btu.

**Energy Consumption by Fuel Type
Transportation Sector, Nebraska, 1960 - 2017**



Source: NDEE

Figure 18

Nebraska produces approximately 14% of the nation's fuel ethanol, ranking second in the country. Ethanol optimizes the golden triangle of renewable energy, crops and animal agriculture. In 2018, 38.7% of Nebraska's corn crop (686.9 million bushels) was used by the 25 Nebraska-based ethanol plants to produce 2.1 billion gallons of ethanol. Ethanol consumption in the state totaled 73.5 million gallons in 2018, representing nearly 4% of Nebraska's production of ethanol. In addition, more than 6 million tons of distiller's grain, a high protein feed for cattle, were produced.

Nebraska produces approximately 14% of the nation's fuel ethanol, ranking second in the country.

By the end of 2018, the Access Ethanol/USDA Biofuels Infrastructure Partnership (AEN/BIP) had provided federal/state funding for the installation of 88 blender pumps at 22 fuel sites, which distributed 9.6 million gallons of E15 and E85 from 2016-2018. AEN/BIP is a public/private partnership of NDEE, Nebraska Corn Board, Nebraska Environmental Trust, Nebraska Ethanol Board, Renewable Fuels Association and the Nebraska Department of Agriculture. In 2019, the Legislature passed LB 585, Nebraska Renewable Fuels Infrastructure program, which will allow for the placement of additional ethanol blender pumps throughout the state, subject to the availability of funding resources.

A recent USDA study mentions the positive environmental impact of the use of ethanol due to a 39% reduction in greenhouse emissions from corn-based ethanol, compared to gasoline. The reduction could be as high as 43% when the ethanol is refined at clean burning natural gas-powered facilities, which is the case in Nebraska with few exceptions.

Nebraska exported 2.03 billion gallons of ethanol in 2018 to be used across the country and internationally. According to "USDA Global Agricultural Trade State," USDA Economic Research Service's latest report, Canada and Mexico purchased 29.1%, or 589.7 million gallons, of ethanol from Nebraska.

The EPA has initiated rulemaking to grant a Reid vapor pressure (RVP) waiver for fuel blends containing gasoline and up to 15% ethanol (E15). This will allow E15 to be sold year-round rather than just the current eight months of the year. This rule would apply to all fuel containing 15% ethanol.

Demand

Nearly a fourth – specifically 23%, or 202.3 trillion Btu – of the state's total energy consumption was used in the transportation sector in 2017. The increase in demand from 2016 to 2017 totaled 7.72 trillion Btu, an increase of 0.9%.

In 1960, the transportation sector was the largest energy-using sector at 94.2 trillion Btu, 30.6% of consumption of all sectors. By 2017, the transportation sector had been eclipsed as the largest energy-using sector by the industrial sector, as noted in the industrial sector portion of this document.

Consumers and Total Miles Traveled

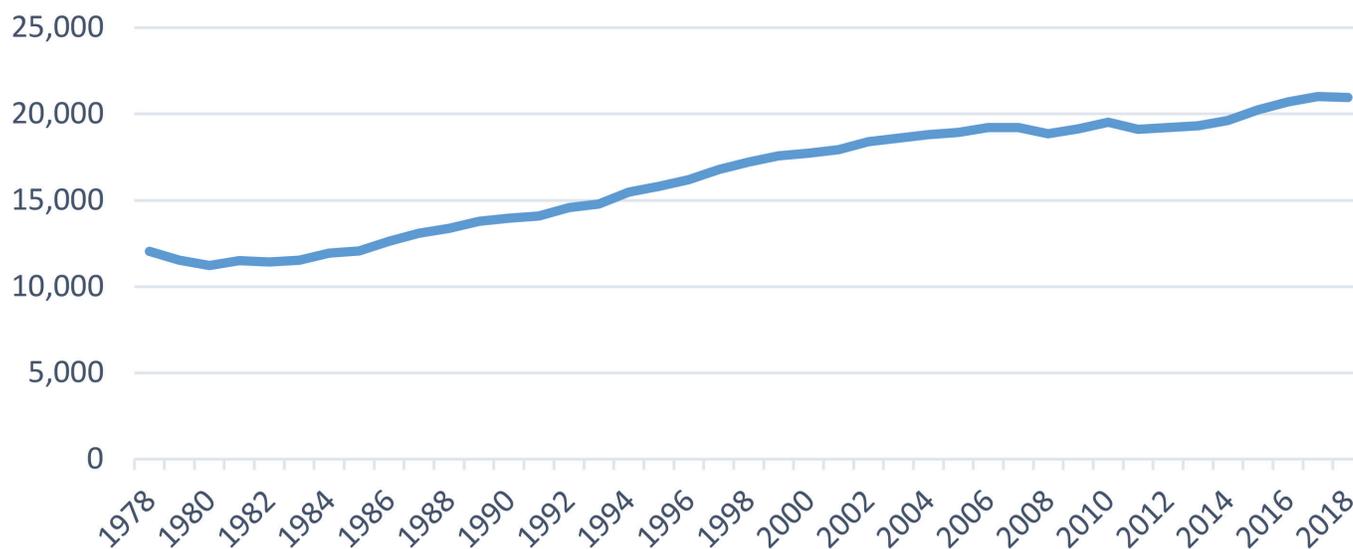
Every year, automotive engineers improve the fuel economy of all vehicles, reducing demand for liquid fuels. However, there are two offsetting trends that push that demand higher. The first is the long-standing trend of consumers purchasing sport utility vehicles and pickup trucks, which have lower fuel economy, rather than passenger cars. The second trend is the gradual increase in the number of motor vehicle miles traveled (Figure 19). This annual total has increased nearly every year from 1978 (12.09 billion miles) to 2018 (21.0 billion miles).

Vehicle Technology

Trends in price and vehicle technology, as well as federal government requirements such as more efficient vehicles, will have an impact on energy use in this sector in the future, leading to declines in consumption. A shift is underway from gasoline-powered vehicles to alternative fuel powered vehicles that will improve air quality. Alternatives include hybrids, compressed natural gas, high ethanol blends and electric vehicles. Hydrogen vehicles, while few, may play an increasing role provided technological challenges can be addressed.

The wide introduction of engines optimized

Vehicle Miles Traveled (Million Miles)



Source: NDEE

Figure 19

to work with higher ethanol blends may have a significant impact on energy use. These lower-displacement, higher-compression engines would use mid-level ethanol blends (15 to 40%), offer fuel economy similar to gasoline, reduce pollutant emissions and expand the market for ethanol.

The auto industry is also investing heavily in electric vehicle technology. According to the Alliance of Automobile Manufacturers Advanced Technology Vehicle Sales Dashboard, as of June 2019, there were 677,324 battery electric vehicles (BEV) registered in the United States, along with 528,838 plug-in hybrid electric vehicles (PHEV). In Nebraska, June 2019 figures were 929 BEV and 1,146 PHEV registered. However, according to the Edison Electric Institute, the electric vehicle market share in the United States, while increasing, was still only 1.8% in March 2019. In Nebraska, BEVs represent 0.17% of all light-duty vehicles, and PHEVs are at 0.19%.

A number of factors have limited consumer acceptance of electric cars, including purchase price, limited variety of vehicles, low dealer stocks, driving range on a charge, charging availability and charging time. Rapid advancements have been made on a number of these issues; for example, cost is going down and batteries are improving the driving range. These advances, coupled with an increasing number of

charging stations, are expected to facilitate the growth of electric vehicles.

Electric Vehicle Purchase Price and Availability

An electric car has far fewer moving parts and requires 30% less labor to build, according to Ford and the United Auto Workers, so they should cost less than gas powered cars. The primary factor keeping EV purchase price high is battery prices, but consumers may be passing a threshold there. A cost of \$100 per kilowatt-hour (kWh) of battery power has long been thought to be a turning point for electric cars in terms of cost competitiveness with gasoline-powered cars. (A kWh is a unit of energy that measures the amount of power produced or used over a one-hour time interval. A 100 - watt light bulb operating for ten hours would use one kWh of energy. A unit of energy equivalent to one thousand watt hours.) Volkswagen claims to have broken that price and Tesla has said it is close. In 2015, batteries were 57% of the cost of a U.S. medium-size electric car, and now that figure is 33% with prices continuing to fall, according to Bloomberg. Purchase price may drop because electric powertrain prices are also dropping as large volume manufacturing has ramped up.

A decade ago, available electric vehicles were almost exclusively sedans and hatchbacks. The

sector now includes sport utility vehicles (both BEV and PHEV) with a variety of price points and amenities, and battery-electric pickup trucks are in development. Most major car manufacturers have announced conversion of most or all of their offerings to battery electric vehicles over the next decade. Research firm IHS Markit forecasts that by 2026, there will be more than 130 models of electric vehicles in the U.S. market, from 43 brands.

Driving Range and Charging

Today, the driving range on new EVs commonly exceeds 200 miles per charge, which is longer than passenger cars are typically driven in a day. Charging times continue to drop. At home, a consumer charger can recharge a battery from empty to full overnight and public fast chargers can add 60 to 100 miles of driving range in 20 minutes. Those times continue to fall as technology improves. The U.S. Department of Energy reports that there are 66,000 electric charging outlets in the country. They report that, nationally, public charging stations numbered only 506 at the end of 2010 and, as of May 2019, there were over 20,000. Volkswagen alone, as part of its diesel

emissions violation settlement, is in the process of spending \$2.1 billion on additional U.S. public chargers.

The number of public charging stations in Nebraska has grown to approximately 80 in 2019, and NDEE is currently awarding rebates totaling \$1.8 million to install additional public chargers in 2020-2021 using funds from the Volkswagen settlement.

Projections of future sales of electric vehicles in the United States vary widely, though most sources have revised their projections upward in recent years. The Edison Electric Institute has made an optimistic projection that by 2030, there will be 18.7 million electric vehicles on U.S. roads, with annual vehicle sales exceeding 3.5 million, or more than 20% of all sales. In contrast, the EIA predicts that only 11.3 million electric vehicles will be on the road in 2030, or 7.6% of all cars.

Current sales of electric vehicles are much higher on the coasts than in Midwestern states, including Nebraska. It is likely that growth in electric vehicle adoption in Nebraska will continue to lag behind the coastal states and conform to more pessimistic growth projections.

Electric Power Sector

The electric power sector consists of facilities that generate electricity primarily for use by the public. Energy is used for the generation, distribution and transmission of electric power.

Energy Supply

Looking at Figure 20, in 2017, 60% of the electric power energy feedstocks came from coal, 220.45 trillion Btu out of a total of 368.39 trillion Btu. The second-most used fuel in this sector, nuclear, supplied nearly 27%, 97.80 trillion Btu. Three lesser fuel sources supplied nearly all the remainder:

- hydropower, 2.15% or 7.91 trillion Btu;
- wind, 9.52% or 35.07 trillion Btu; and
- natural gas, 1.68% or 6.17 trillion Btu.

Generally, supplies of these fuel types have been readily available to consumers served by the state's electric utilities.

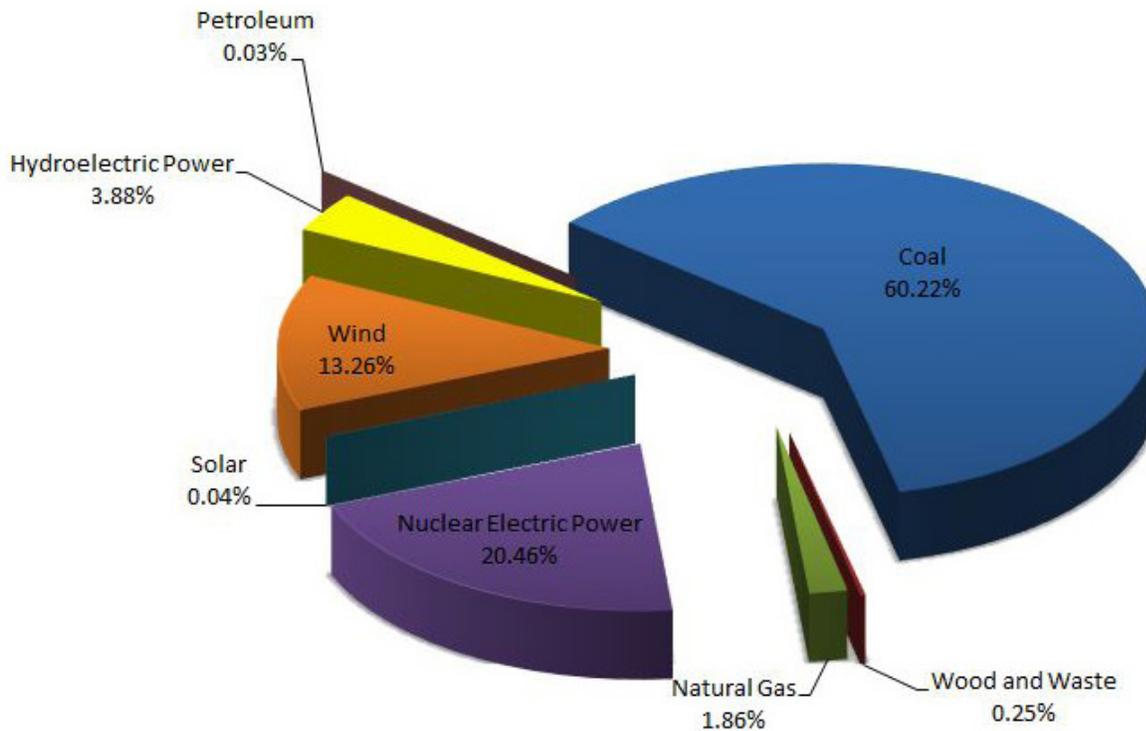
As shown in Figure 21, trends in fuel types used by the state's electric utilities illustrate how the industry has evolved over 57 years. In 1960, 63.9% of the electricity generated came from natural gas, with hydropower (20.6%) and coal (12.6%) supplying most of the balance. An experimental nuclear reactor was located at

Nebraska's electric utilities more than met their customers' needs.

Hallam and operated between 1963 and 1964, but generated only marginal amounts of power before being deactivated. Coal used in this sector peaked in 2013 at 272.66 trillion Btu, natural gas use peaked in 1973 at 53.11 trillion Btu, nuclear power – which began in 1973 – peaked in 2007 at 115.82 trillion Btu, hydropower peaked in 1999 at 17.58 trillion Btu and wind use peaked in 2017 at 46.84 trillion Btu.

In 2008, three public power utilities in

Energy Consumption by Fuel Type Electric Power Sector, Nebraska, 2017



Source: NDEE

Figure 20

Nebraska joined the Southwest Power Pool, a regional transmission organization, to provide more operational flexibility as part of a larger, regional service area. The net result is that utility customers region-wide get electricity generated at the lowest marginal cost. This also gave local public power districts greater flexibility in contracting for wholesale power that they distribute to their commercial and residential customers.

Demand

The demand in the state's electric power sector in 2017 totaled 353.3 trillion Btu, a decrease of 4.1%, or 15.1 trillion Btu, from 2016 demand.

Among the changes in fuel used to generate electricity in 2017 were increased use of wind, hydropower and natural gas along with reductions in nuclear and coal.

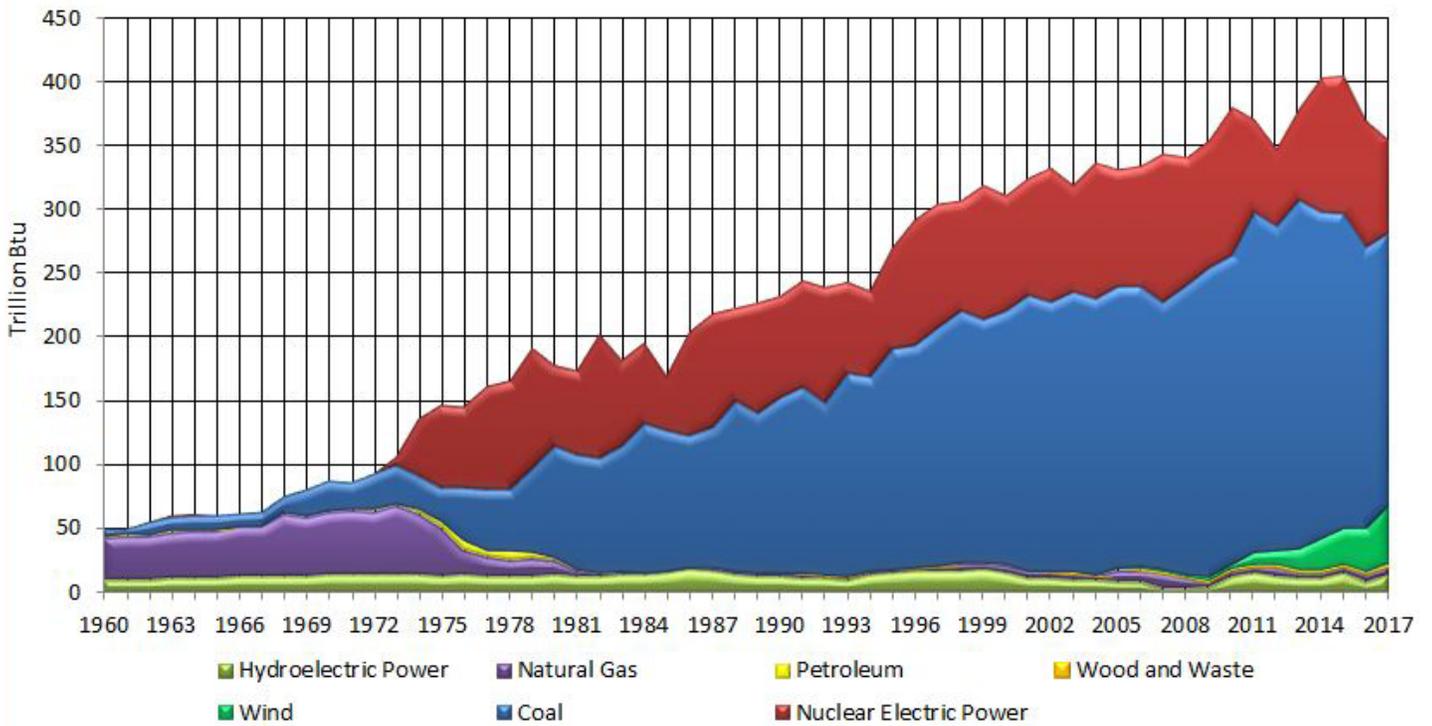
Electricity purchases generated by hydropower for use by Nebraska utilities from the Western Area Power Administration in 2017 totaled 1.982 billion

kilowatt hours at an average price of four cents per kilowatt hour. The total cost of the power purchased in 2017 was \$72.31 million. In 2017, the amount of power provided from Western Area Power Administration met 6.7% of the electricity demand in the state. In 1960, the state's electric power demand was 50.2 trillion Btu. By 2017, the demand in this sector had increased more than seven-fold from 1960 to 353.3 trillion Btu.

Over the 57-year period, only 17 years recorded declines in demand. A number of these declines were marginal; however, larger declines in demand paralleled economic cycles as well as favorable climate periods that affected irrigation and air conditioning use.

Nebraska's electric utilities more than met their customers' needs while continuing to export electricity to customers outside the state. Between 1990 and 2017, electricity exports varied from a low of 9.4% of generation in 1994 to a high of 26.1% in 2015. In 2017, electricity exports were 14.3% of generation. This was a drop of 3% from 2016.

Energy Consumption by Fuel Type Electric Power Sector, Nebraska, 1960 - 2017



Source: NDEE

Figure 21

Questions or comments on this Annual Energy Report may be submitted to neo.energy@nebraska.gov.