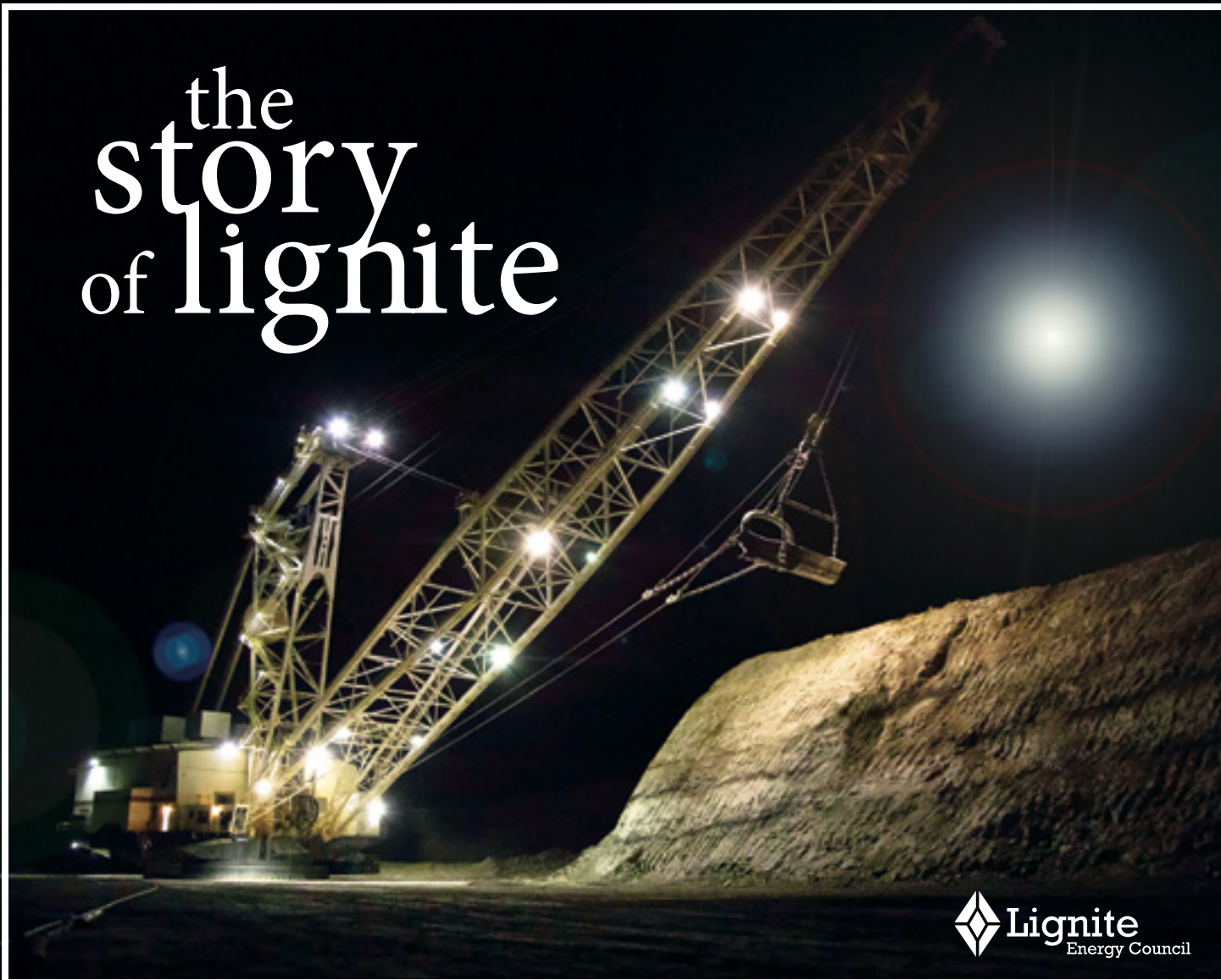


the story of lignite



bringing reliable energy to the region

- \$5.4 billion impact on North Dakota
- 2 million regional customers
- Electricity costs below national average

As the number eight coal producer in the nation, North Dakota mines between 25 million and 30 million tons annually. With abundant water resources, lignite coal helps meet the high demands for a reliable and affordable source of electricity in the Upper Midwest.

Nearly 80 percent of the lignite coal mined annually in the state is used to generate affordable, reliable electricity, serving more than 2 million people in the region; about 20 percent is used to make synthetic natural gas that is delivered to 400,000 homes and businesses in the eastern United States, three valuable fertilizer products – urea, anhydrous ammonia and ammonium sulfate, along with carbon dioxide used for enhanced oil recovery and other valuable chemicals.

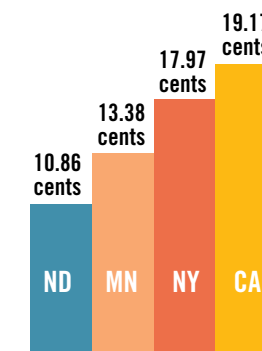
Seven generating plants

Much of the region's electricity is generated from lignite at six power plants in west-central North Dakota and one east of Jamestown. Lignite also fuels the nation's only coal-to-natural gas coal gasification plant, also in west-central North Dakota.

Generating affordable, reliable electricity

Lignite-based power plants supply affordable, reliable electricity around the clock. The average price of electricity in 2018 from North Dakota's lignite-based power plants was \$27.15 per megawatt-hour. That compares with \$32.29 for all U.S. coal-based power plants and \$33.44 for U.S. natural gas-based plants. A megawatt-hour is enough electricity to serve about 800 homes with an hour's worth of power.

Coal is our primary source of electricity in North Dakota and U.S. coal reserves represent the largest single unit of energy in the world, secure within the borders of one country.



Average Residential Retail Price per Kilowatt-Hour

Source: U.S. Energy Information Administration



producing jobs and economic stability

- 3,623 workers directly employed
- 9,500 secondary employees
- \$125 million in state tax revenue

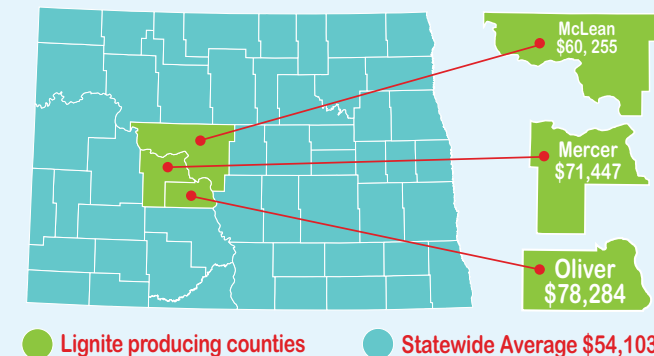
Jobs and Economic Impact

The lignite industry employs 3,623 workers directly. Indirectly, the industry supports another 9,500 workers from business activity that is attributable to the lignite industry.

Oliver, Mercer and McLean Counties are home to five lignite mines, six power plants and the nation's only coal-to-natural gas coal gasification plant. In 2019—the most recent year the ND Job Service has recorded—these three counties all had average wages above the state average of \$54,103.

According to the North Dakota State University Agricultural Economics Department, the lignite industry is the state's fifth largest industry behind agriculture, petroleum, tourism and manufacturing.

2019 ND Average Annual Wage by County



Tax revenues


Lignite industry companies contribute substantially to North Dakota tax revenues. Total annual taxes, including sales, personal and corporate income taxes are estimated to be about \$125 million in 2017.





North Dakota's homegrown lignite in 2022

- Approximately one-quarter of the lignite industry could disappear after 2022
- Coal Creek Station, Spiritwood Station and Heskett Station scheduled to quit using lignite
- Plant closures will affect mine production



The Department of Agribusiness and Applied Economics at North Dakota State University is currently investigating the loss of jobs, revenue and taxes to the state and to specific counties following the announcement that three coal-based power plants will quit using North Dakota's homegrown lignite coal in 2022.

The largest is Coal Creek Station, owned and operated by Great River Energy. Besides generating electricity, the Station also sells fly ash for a cement replacement and provides process steam for the adjacent Blue Flint ethanol biorefinery. Located near Underwood, North Dakota, the Coal Creek Station purchases about 7.5 million tons of lignite annually from the Falkirk Mine, also located in McLean County. There are efforts underway to find a buyer for this plant.

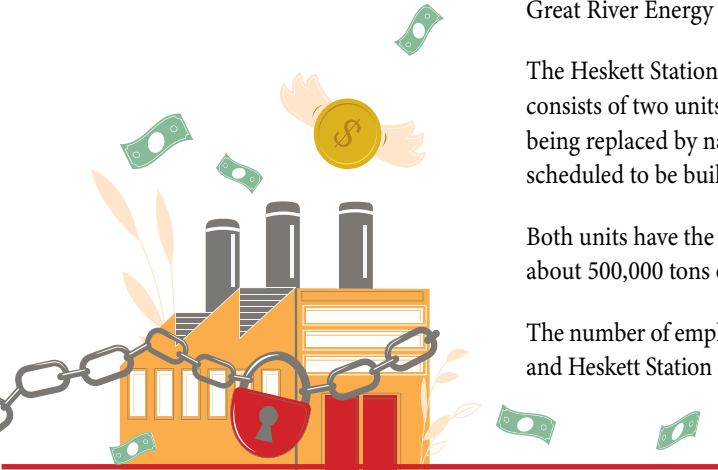
Coal Creek Station has a capacity of 1,100 megawatts. The plant is scheduled to shut down in the second half of 2022 due to economic reasons unless a buyer is found.

The Spiritwood Station, the state's newest power plant, is scheduled to switch to natural gas. The plant has already been using natural gas as a fuel depending upon commodity prices. Great River Energy owns this Station, near Jamestown, North Dakota, as well.

The Heskett Station, north of Mandan, North Dakota, has reached its end-of-life. The Station consists of two units. The oldest went online in 1954 and the second in 1963. The generation is being replaced by natural gas-fueled turbines. One has already been built and the second one is scheduled to be built before the decommissioning of the coal-based power plant in March 2022.

Both units have the capacity to produce a total of about 100 megawatts. Heskett Station purchases about 500,000 tons of coal annually from the Beulah Mine.

The number of employees at the Falkirk and Beulah Mines would also be cut if Coal Creek Station and Heskett Station close. However, some employees would remain for reclamation purposes.



practicing environmental stewardship

- 20,000 acres released from bond
- \$30,000 to \$60,000 per acre to reclaim land
- GPS increases reclamation efficiencies

◀ Reclamation is accomplished contemporaneously with mining. At BNI Coal's Center Mine, about 200 acres are disturbed by mining annually and 200 acres are reclaimed, thus the footprint of the mine may move from year to year, but it stays relatively constant in size.

Each power plant using lignite is in compliance with all state and federal ambient air quality standards. In fact, North Dakota is one of only 14 states that meet all federal ambient air quality standards as of 2019.

North Dakota's lignite industry is recognized as an industry leader for installing and operating emissions control technologies including electrostatic precipitators, scrubbers, spray dryers, baghouses and selective non-catalytic conversion technologies to reduce particulates and other emissions.

Reclamation results

Mining companies spend an average of \$30,000 to reclaim one acre of land, but costs can run as high as \$60,000 an acre. That's a considerable cost compared with the average cost of farmland in west-central North Dakota.

After mining, coal mining companies have a maximum of three years to reclaim the land by grading and re-spreading the soil and seeding the land. From then on, the mines have to keep the reclaimed land under performance bond for at least 10 years and prove that the reclaimed land produces crops or forages as good or better than before the land was mined.

After the minimum 10-year revegetation liability ends, mines can request a final bond release to terminate the North Dakota Public Service Commission's jurisdiction over the reclaimed lands.

About 20,000 acres of mined land in North Dakota has gone through final bond release. This is the equivalent of about 30 square miles.

attributes of coal-based electricity

- Fuel security
- Reliability and resilience
- Energy abundance

◀ North Dakota's largest coal plants are located adjacent to the mines that supply the coal.

Fuel security

Maintaining a supply of coal at each coal-fueled power plant provides fuel security because on-site stockpiles of coal minimize the potential impact of fuel supply disruptions. Since North Dakota's largest plants are sited next to the lignite mines, they have a nearly inexhaustible supply of fuel.

Reliability and resilience

There are at least 16 distinct attributes that contribute to grid reliability. Coal-based power plants possess almost all of these attributes (dispatchability, voltage control, frequency response and price stability, to name a few).

Energy Abundance

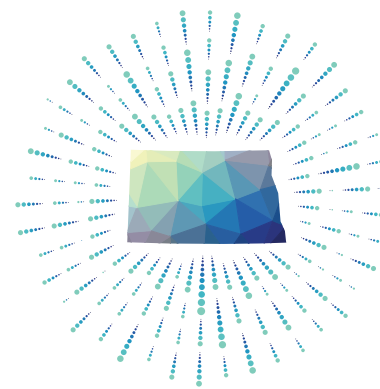
The United States has more coal (477 billion tons) than any other country and eclipses remaining U.S. oil and natural gas resources. North Dakota has the second largest known reserve of lignite in the world, second only to Australia. The abundance of coal is a competitive advantage as researchers look for newer and better ways to use this resource -- not only to generate electricity but also to make fertilizers, chemicals and other valuable carbon-based products.

For more information about the attributes of clean, coal-based electricity, go to www.lignite.com.



research and development

- State and industry partnership
- More than \$90 million invested by State of North Dakota
- More than \$750 million invested in R&D program since 1987



North Dakota is considered a pioneer when it comes to lignite-based research and development. This stems from the origination of an industry-state partnership dating back to 1987. Since that time, the Lignite Research and Development Program has steadily grown. The result has been an industry that is cleaner and more efficient.

Over the years, numerous projects have developed cost-effective technologies to reduce criteria pollutants such as sulfur dioxide and nitrogen oxides. More recently, the seven North Dakota lignite-based plants joined forces with utilities in the Gulf Coast region to find ways to capture mercury from flue gases. Today, every North Dakota power plant is equipped with mercury reduction equipment.

Mine reclamation has also been a topic of R&D projects and better ways to reclaim mined land was one of the first challenges faced by the industry. A multi-year project is currently underway to review the reclamation practices. One of the goals is to reduce the soil compaction normally associated with heavy equipment used to reclaim land.

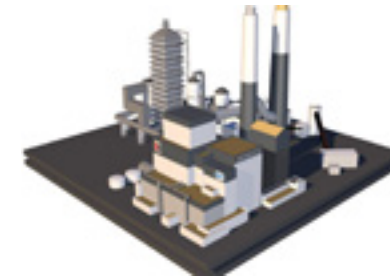
To be considered by the Lignite Research Council, the organizations promoting the new technologies have to secure matching funds and team with companies actively involved in the lignite industry.

All proposals are thoroughly reviewed by three separate independent experts before being voted on by the Lignite Research Council. If approved by the 24 members of the LRC, they are then forwarded to the North Dakota Industrial Commission, composed of the Governor, Attorney General and Commissioner of Agriculture for funding consideration.

The state money comes from several sources including the coal conversion and coal severance taxes. It has recently been supplemented by tax revenue from the petroleum industry. Since 1987, the state has invested more than \$90 million in lignite research funds. Total investment in more than 200-plus projects is in excess of \$750 million.

Project Tundra

- Capture more than 90 percent of CO₂
- Would be the largest CO₂ capture facility in the world
- Projected costs of \$1 billion



◀ **Milton R. Young Power Plant is located in Oliver County, southeast of Center, North Dakota.**

Project Tundra is an effort being led by Minnkota Power Cooperative to install carbon capture technology at the coal-based Milton R. Young Station near Center, N.D. The amine-based CO₂ capture technology central to Project Tundra has been successfully demonstrated at the Petra Nova project in Texas. However, Project Tundra at the Young Station would be the largest CO₂ capture project on a coal plant in the world—the equivalent of removing 600,000 gasoline-fueled cars off the road.

Research

Minnkota Power Cooperative and the Energy & Environmental Research Center (EERC) at the University of North Dakota are working on a Front-End Engineering Design (FEED) study at the Young Station, which includes advanced design, engineering and an evaluation of project economics. The EERC is recognized as one of the world's leading developers of cleaner, more efficient energy and environmental technologies. Minnkota anticipates conducting research and advanced design work into 2021.

Cost

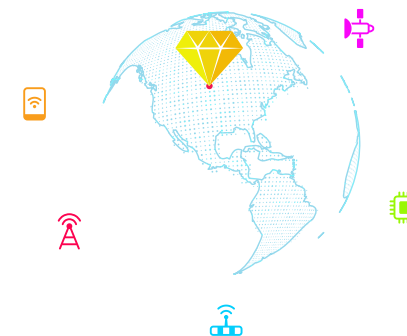
Project Tundra is estimated to cost approximately \$1 billion. The project is currently seeking partners to help monetize 45Q federal tax credits, which are currently \$50 per ton of CO₂ that is captured and stored in a geologic formation deep underground or \$35 per ton that is captured and used for enhanced oil recovery. Minnkota secured \$20 million from the State of North Dakota's Lignite Research Fund and nearly \$10 million from the Department of Energy to help support the FEED study and geologic storage work currently underway.

Safe and Permanent Storage

North Dakota's geology is ideal for safe and permanent geologic storage of CO₂. A deep porous rock layer will hold the CO₂ more than a mile underground and overlying and underlying cap rock layers will seal the CO₂ in the storage zone. The project is currently focused on developing a saline storage facility near the plant, though enhanced oil recovery in North Dakota's oil fields still remains a future possibility.

rare earth elements

- Rare earth elements are an emerging market for North Dakota lignite
- Most rare earth elements are currently imported from China
- Rare earth elements aren't rare, but are valuable



Modern life revolves around electronics and at the heart of the high-tech world is rare earth elements (REEs) almost all imported from China. But North Dakota deposits of lignite are comingled with rare earth elements. The key to unlocking this billion dollar market is identifying commercially viable technologies to extract and concentrate rare earth elements.

The North Dakota Geologic Society identified what potentially can be a major market for companies already involved in the lignite industry. Today, the United States consumes about 16,000 tons of rare earth elements every year and is essentially 100 percent dependent on imports for these materials. High-tech military defense systems along with modern energy systems and consumer goods – such as smartphones -- rely on REEs.

Why is North Dakota unique?

- Studies by the North Dakota Geological Survey show that North Dakota lignite may have some of the highest concentrations of certain REEs in coal seams in the nation.
- The elements contained in the coal samples show North Dakota has some of the heavier, more valuable REEs, such as scandium.

Currently researchers at the Energy & Environmental Research Center (EERC) at the University of North Dakota are developing technologies to commercialize REEs from lignite coal. Several utility and mining companies have partnered with the EERC to develop economically viable extraction and concentration methods for REEs from lignite and lignite ash.

Rare earth elements are just one of several potential new markets for the lignite industry. Others include electric vehicles and turning carbon into graphene. More information is available on [emerging markets](#).

Sc
Scandium

La
Lanthanum

Ce
Cerium

Nd
Neodymium

Eu
Europium

Gd
Gadolinium

Dy
Dysprosium

Er
Erbium

Yb
Ytterbium

Y
Yttrium

Lu
Lutetium

Pr
Praseodymium

Pm
Promethium

Sm
Samarium

Tb
Terbium

Ho
Holmium

Tm
Thulium



information at your fingertips

Feel free to contact us:

If you are a member of the Lignite Energy Council, an elected official or someone who has a question about the industry, you might like to know who to contact. Here are three that can help you:

Government Affairs:

Jason Bohrer

President and CEO,
Lignite Energy Council
701-355-2185 or
jasonbohrer@lignite.com

Jonathan Fortner

Vice President of Government Affairs
and External Relations,
Lignite Energy Council
701-355-2189 or
jonathanfortner@lignite.com

Public Affairs:

Steve Van Dyke

Vice President of Communications,
Lignite Energy Council
701-355-2193 or
stevevandyke@lignite.com

Thank you for taking the time to become better informed about the regional lignite industry. However, all you've seen so far is the tip of the iceberg.

If you would like to know more about this industry and its attributes such as jobs, taxes, reliability and affordability, here are some additional links for you to check out at your leisure.

In 2020, we have had special virtual town hall meetings with North Dakota's Congressional Delegation. The last one was with [Representative Kelly Armstrong](#), but we also recently conducted calls with our U.S. Senators [Kevin Cramer](#) and [John Hoeven](#).

In May 2020, we debuted a 30-minute film about the lignite industry titled "[Coal: Powering the Past, the Present and the Future](#)." The film encapsulates our industry and is told by the very people who are connected to it—including elected officials, industry executives, miners, utility employees, researchers and others.

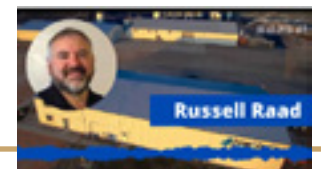
We have supplemented that video production with a series of short videos called "[I am Lignite](#)."

We have also completed our second season of [Podcasts](#). Our guests talk about a wide variety of subjects tied to the lignite industry.

You can also follow us on our social media channels—such as [Facebook](#) and [Twitter](#).

We also have frequent guests on the Energy Matters radio show on Tuesday afternoons. The show is on KFYZ radio—550 AM.

Finally, remember to bookmark our Website at www.lignite.com.





The Lignite Energy Council is a regional trade association representing mining companies that produce 30 million tons of lignite annually, utilities which generate affordable, reliable and clean electricity for 2 million people in the Upper Midwest and businesses providing goods and services to the mines and plants. In total, the North Dakota lignite industry represents \$5.4 billion in gross business volume and provides the state of North Dakota with more than \$125 million annually.

Learn more at www.lignite.com