Lignite: The Region’s Best Kept Secret

Daryl Hill
Retired Spokesman
Basin Electric Power Cooperative
North Dakota

- How many from MT, SD and MN?
- What are your impressions of ND?
- What mining operations occur in:
  - MN
  - SD
  - MT
North Dakota

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  – MN – iron ranges
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North Dakota

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  – SD – Black Hills gold
  – MT
North Dakota

• How many from MT, SD and MN?
• What are your impressions of ND?
• What mining operations occur in:
  – MN – iron ranges
  – SD – Black Hills gold
  – MT -- copper
U.S. Coal Deposits

- **Lignite**
- **Subbituminous**
- **Bituminous**
- **Anthracite**

Map showing the distribution of coal deposits across the United States.
• North Dakota produced 29.1 million tons of lignite in 2017
• The industry has produced an average of 30 million tons since 1988
Regional Transmission Organizations

RTO markets are now the dominant form of energy dispatch in the country.

Why? An RTO can serve the loads more cost effectively vs. stand alone utilities.

Thus, saving customers money.
Average Electricity Costs
2016 Megawatt-Hour

- North Dakota Lignite Plants: $24.23
- All Nuclear: $23.08
- All Coal: $32.01
- All Natural Gas: $29.97

Source: Ventyx
Regional Low-Cost Electricity

Average 11/1/17 residential electricity prices –
Source EIA (Table 5.6.A)

<table>
<thead>
<tr>
<th>State</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND</td>
<td>9.7 cents</td>
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<tr>
<td>MN</td>
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<tr>
<td>NY</td>
<td>17.8 cents</td>
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<tr>
<td>CA</td>
<td>18.7 cents</td>
</tr>
<tr>
<td>HI</td>
<td>30.6 cents</td>
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</tbody>
</table>
Who Are the Players?
Lignite Energy Council

Member-driven association

- 270+ Contractor/Suppliers
- 6 Utilities
- 4 Producers, 1 Reserve Holder, 1 Research Member
- 1 Development Member
- 1 Gasification Company
Basin Electric Power Cooperative
Service Area

- Serves 141 distribution co-ops
- 3.0 million customers
- 1,569 MW from lignite
- ~2,000 MW from sub-bituminous
- 2,300 employees including 500+ at BEPC headquarters – 700+ at Synfuels plant
- BEPC owns Dakota Gasification Company
Minnkota Power Cooperative
Service Area

- Serves 11 distribution co-ops
- 140,000 customers
- 708 MW from lignite
- 361 employees including 175 at HQ
Great River Energy

Service Area

- Serves 28 distribution co-ops – about 60% of Minnesota geographic area
- 650,000 customers
- 1,140 MW from lignite
- 240 employees at HQ (Maple Grove) and 270 employees at Coal Creek Station and 33 employees at Spiritwood Station

Maple Grove
Lignite’s Primary Electric Service Areas
*Rural Areas Served by Rural Electric Cooperatives*

- **Basin Electric**
- **Great River Energy**
- **Minnkota**
Montana-Dakota Utilities Co.

Electric Service Area

- Serves 135,000 electric customers
- 250 MW from lignite
- 252 employees at HQ (Bismarck), 26 employees at Lewis & Clark Station, and 51 employees at Heskett Station

Blue represents service territory and red dots denote generation sources – MDU’s electric customers have grown along with Bakken oil boom
Otter Tail Power Company
Service Area

- Serves 130,000 electric customers
- 149.5 MW from lignite
- 315 employees at HQ (Fergus Falls) and 82 employees at Coyote Station
Minnesota Power
Service Area

- Serves 144,000 electric customers
- 225 MW from lignite
- 1,000 employees in electric operations
Lignite’s Primary Electric Service Areas
*Rural Areas Served by Investor-Owned Utilities*

- Montana-Dakota Utilities
- Xcel Energy
- Otter Tail Power
- Minnesota Power
Lignite Energy Industry History

- Four distinct stages of coal mining in North Dakota
  - Birth of the coal industry, 1873 – 1900
  - Rise of commercial mining, 1900 – 1920
  - From underground to surface mining, 1920 – 1951
  - Emergence of lignite for electric generation, 1952 to present

Source: A History of Coal Mining in North Dakota by Colleen Oihus with North Dakota Geological Survey and North Dakota Public Service Commission
President Jefferson’s instructions included “recording their findings of pit coal” and other natural resources.
General Custer escorted a group of men from Bismarck to open a coal mine near the present town of Simms, ND, in 1873.
This mine east of Dickinson was named for an existing coal mining region in Pennsylvania.
Natural outcroppings of lignite were always fair game for early mining activities by homesteaders.
Many of the early mines were family-owned as they helped supplement the earnings from farming.
Immigrant Train

Many families arrived in North Dakota, thanks to the enticement and advertisements of railroads.
Lignite Energy Industry History

• Birth of the coal industry, 1873 – 1900
• Rise of commercial mining, 1900 – 1920
Washburn Coal Co.

Some of the first gambling in the state? Guess the weight of the coal and win the fuel.
“It's dark as a dungeon and damp as the dew, Where the dangers are double and the pleasures are few, Where the rain never falls and the sun never shines… It's dark as a dungeon way down in the mines.”
A typical horizontal mining plan – timbers and pillars were used to support mining activities. Consider the depth of the coal seams...might be just tall enough for a man to stand.
Falkirk Reclamation Video
Falkirk Mine 2014 Reclamation Award from the ND PSC
“A foreman would grab your arm. If you had a sleeve full of muscles, you could get job as a miner.”
Horses and mules lived underground. They would go blind if they ever saw the sun.
The Joy loaders made underground mining more efficient
Eventually, the mules were replaced by little engines.
Lignite Energy Industry History

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• From underground to surface mining, 1920 – 1951
Underground Miners
Steam Shovel
Williston Power Plant
Knife River Station
Many factors affected the lignite industry over the years

- The Depression – reduced economic activity
- Opening the Garrison Dam – made hydro power readily available to co-ops and municipal electric systems
- Drilling rigs found natural gas associated with oil
Garrison Dam
Drilling Rig
Lignite Production 1920-1965

North Dakota
History of Power Activity

• What was life like without electricity?
  – Invite to class a great-grandparent who grew up on a farm without electricity
  – Research the local newspaper or utility archives to find when electricity came to town
  – Utility history books – Energizers of the Prairie, The Power People, etc.
  – Who were the “Edison’s” of your community
Reddy Kilowatt (video)
Willie Wiredhand

- The rural electric cooperatives had Willie Wiredhand as a mascot. He was advertised as a farm hand who showed up on time, worked for pennies a day, and took over the milking, grain handling, water pumping and other chores...and he didn’t talk back to the boss.

- Do we still think of electricity as a servant or is it something we take for granted?
‘One of the Happiest Days of My Life’

• Rose Frohlich lived on a farm between Center and Mandan with her family in the 1940s. Mor-Gran-Sou electrified her farm house on June 8, 1949. She called it “one of the happiest days of my life.”

• Laundry, bathing children, feeding her family, cleaning her home and preserving her fruits, vegetables and meat got a lot easier.
Did You Know?

The typical U.S. home in 2016 has, on average, at least 25 electronic products – 99 percent of which must be plugged in or recharged.

99% have televisions
99% have refrigerators
82% have clothes washers
79% have clothes dryers
76% have at least one computer
61% have central air conditioning
59% have dishwashers
Willie was Right!

- Modern production agriculture is powered by electricity
  - Farm irrigation systems are major consumers of electricity – irrigated crops accounted for 40% of all the ag products sold in 2012
  - Electricity is the largest single energy expense for dairy farmers. The automatic milking parlor is powered by electricity and the milk is chilled on site
  - The milling of wheat includes cleaning, grinding, sifting for size and density, material handling and packaging. In flour production, the largest single operating expense is electricity used to run motors.

Nearly all activities supporting production agriculture requires energy.
Lignite Energy Industry History

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- Emergence of lignite for electric generation, 1952 to present
Heskett Station

- Named for MDU’s founder – R.M. Heskett
Leland Olds Station
Milton R. Young Station
Coyote Station
Coal Creek Station
Antelope Valley Station
Spiritwood Station

- A unique combination – heat and electricity
  - 77 MW base load
  - 22 MW steam peaking
  - 610,000 ton/yr. beneficiated lignite
  - Investment...$400M
Great Plains Synfuels Plant
# Mines and Power Plants

<table>
<thead>
<tr>
<th>Mine</th>
<th>Plant(s)</th>
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<tbody>
<tr>
<td>Center</td>
<td>Milton R. Young</td>
</tr>
<tr>
<td>Freedom</td>
<td>Great Plains / AVS / Leland Olds</td>
</tr>
<tr>
<td>Falkirk</td>
<td>Coal Creek / Spiritwood</td>
</tr>
<tr>
<td>Coyote Creek</td>
<td>Coyote Station</td>
</tr>
<tr>
<td>Savage Beulah</td>
<td>Lewis &amp; Clark / Heskett</td>
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</tbody>
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Economic Impact
4,000 Direct Employees
11,000 Indirect Employees
Jobs Created by the Lignite Industry

Direct Job = Indirect Jobs
$1.1 \text{ Billion} = $3.5 \text{ Billion}$
Dollars Created by the Lignite Industry
Total State Taxes (Biennium)
$200 Million
Classroom Activity

ECONOMICS!!!
Lignite Industry
Contractors & Suppliers

• Heavy equipment supplier
• Coal testing lab
• Fuel supplier
• Engineering services
• Earthwork contractor
• Legal services
• Machine shop services

• Maintenance services
• Utilities (electricity)
• Transportation services
• Parts supplier
• Explosives supplier
• Environmental consultant
• Tire supplier
Lignite Industry
Business Activity Generated

- Doctor
- Rent
- Dentist
- Bank (car or house payment)
- Grocer (food)
- Credit card payment
- Telephone
- Insurance payment
- Gas / electricity
- Home improvements

- Water
- Vacations
- Clothing
- Sporting events
- Car repair/maintenance
- Toys for children
- Gasoline
- New car or truck
- Movies
Classroom Activity: Lignite Economics

- **Jobs**
- **Business activity**
- **Tax revenue**

\[
\text{Tax } \$ \quad = \quad \text{Services}
\]