A Look at the Past

- Plant built as a result of ‘70s energy shortages
- $2.1 billion cost, 4 years to build, covers 640 acres, more than 6,000 workers to build facility
- First Synthetic Natural Gas (SNG) produced in July 1984
Construction
Construction
Gasifiers
1980-1984
The early years

• Five member consortium left project July 1985 (Pacific Lighting Corp., Tenneco, ANR, Transco, Natural Gas Pipeline Co.)
• Dept. of Energy ran project for 3 years
• Dakota Gasification Company (DGC) began operating facility in 1988 as a subsidiary of Basin Electric Power Cooperative
• About $665 million has been invested in the Synfuels Plant since 1988 to achieve environmental compliance, improve efficiency, and diversify the product slate
At a glance

- Member owned
- Member driven
- 3 million member consumers
- 2,400+ miles high-voltage transmission
- $7.6 billion in total assets
- 141 members
- More than 2,200 employees
- Incorporated 1961
- 5 subsidiaries:
  - Basin Electric
  - Dakota Gas
  - Souris Valley
  - Dakota Coal Division: Wyoming Lime
  - Montana Limestone
Generation Portfolio

Maximum winter generation capability: 6,702.4 MW
End of year 2018

- Coal: 44.6%
- Natural gas: 20.4%
- Wind: 20.3%
- Nuclear: 0.9%
- Recovered energy: 0.7%
- Oil/diesel/jet fuel: 2.8%
- Hydro: 4.8%
- Unspecified purchased power: 5.5%
Linked by Design

- Share water, coal, rail infrastructure
- Dakota Gas purchases electricity from Antelope Valley Station adjacent to the facility
- Basin Electric purchases natural gas for gas combustion turbines at seven locations
- Share natural gas pipeline to AVS for boiler startup
Technology Development

• Dakota Gasification Company
  Great Plains Synfuels Plant
  – Produces natural gas from lignite coal
  – Array of other products including fertilizers and chemicals
  – Captures CO$_2$ and sends it via pipeline to Canada for enhanced oil recovery. World’s largest CO$_2$ sequestration project.
  – Tar oil sold into the fuel blending market
  – Urea plant commercial operation February 2018
Synfuels Plant today

- Work Force: more than 730 people
- Start with coal, oxygen and water
- 14 Lurgi gasifiers
- Daily Equivalent Production Capacity: 170 mmscfd SNG
- Produce 13 products
Gasification

- 18,000 tons of lignite coal from the Freedom Mine
- 6.6 million gallons of water, changed to high pressure steam, from Lake Sakakawea
- 3,100 tons of pure oxygen captured in the air separations unit
- 14 Lurgi gasifiers
- Employees’ determination/innovation
Question

What three ingredients do we begin with for the gasification process?

1. Coal, Natural Gas, Oxygen
2. Coal, Oxygen, CO\textsubscript{2}
3. Coal, Water, Oxygen
4. Coal, CO\textsubscript{2}, Oxygen
DGC’s Revenue Mix is Changing

When Basin Electric purchased the Synfuels Plant, only 2% of the revenue was from a product other than natural gas.

Today, 75% of revenue comes from additional products.
2017 product revenue

$337.2 MILLION

- **ANHYDROUS AMMONIA**: 23.7%
- **CARBON DIOXIDE**: 6.4%
- **AMMONIUM SULFATE**: 8.5%
- **PHENOL**: 3.1%
- **CRUDE CRESYLIC ACID**: 1.4%
- **NAPHTHA**: 0.4%
- **TAR OIL**: 6.7%
- **OTHER REVENUE**: 0.8%
- **NATURAL GAS**: 46.4%
Pipeline-quality natural gas

• Average 153 MSCF per day or 35.8 million dekatherms annually
• For home heating and industrial feedstock
Carbon Dioxide

- Up to 2 million tons per year
- Equal to 425,000 car’s yearly exhaust. Average car produces 4.7 tons of CO$_2$ per year.
- Used for enhanced oil production
- More than 35 million tons sent to Canada oil fields since 2000 when capture began
- World’s largest capture and sequestration project
Carbon Dioxide Pipeline

- 205 miles
- Strategically routed through Williston Basin oil fields
- Pipeline taps installed for potential future use
Chemicals & Fuels

• Crude cresylic acid
  – Up to 26 million pounds annually
  – Used for manufacturing numerous chemical products of cresol and xylenol mixtures
  – Wire enamel solvents, thermal insulation

• Phenol
  – Up to 26 million pounds annually
  – Used for resins for plywood manufacturers
Chemicals & Fuels

• Naphtha
  – Up to 8.6 million gallons per year
  – Benzene production and gasoline additives

• Tar oil
  – Up to 1 million barrels per year
  – Residual fuel blends, special carbon black feedstock
Liquefied Gases

• Krypton-xenon
  – Up to 3.7 million liters annually
  – Used in specialty lighting, such as halogen headlights, lasers, projector bulbs, window insulation

• Liquid nitrogen
  – Up to 100,000 gallons per year
  – Used for food processing refrigeration, as an oil well additive and in chemical processes
Fertilizers

• Anhydrous ammonia
  – Up to 400,000 tons per year
  – Marketed to ag fertilizer wholesalers in the Northern Plains, Canada, industrial markets

• Ammonium sulfate - Dak Sul 45®
  – Up to 150,000 tons per year
  – Marketed to ag fertilizer wholesalers in the Northern Plains and Canada
Fertilizer uses

- Anhydrous ammonia primarily used on corn, small grains (wheat, barely, durum) and sunflowers
- Ammonium sulfate or Dak Sul 45® primarily used on canola, sunflowers, corn and small grains
- Urea primarily used on corn, small grains and sunflowers
Question

How many products do we currently produce at the Synfuels Plant?

1. One
2. Six
3. Thirteen
4. Fifteen
Urea

• Planning began in 2012
• Construction began July 2014
• $740 million project
• Mechanically complete November 2017
• Commissioned and producing product January 2018
• Granular fertilizer commonly used in agricultural applications
• Features high nitrogen content, costs less to handle, store and transport
• Safer to handle and transport than anhydrous ammonia
Construction

• Onsite workforce nearly 1,100 - multiple contract companies: general construction, power supply, concrete foundations, tanks, earth work and piping

• Critical pieces of equipment manufactured in Austria, Germany and Japan

• Project includes more than 22 miles of pipe

• Innovative project completed safely
Urea

- Storage facility - 53,000 tons of granular urea
- Truck and railcar load-out facility - capacity to load 65 railcars in a single shipment
- 1,100 tons of urea daily
- Ability to shift urea production to produce diesel exhaust fluid (DEF) - 185,000 gallons daily
- DEF is used to reduce NO_x emissions in diesel engines - mandated by the federal government on new diesel engines
- 1.1-million gallon stainless steel storage tank for DEF
- Plant also produces liquefied carbon dioxide
Melt and Granulation
Committed to Health, Safety & the Environment

- Ambient air and groundwater monitoring
- CO$_2$ emissions reduced by 40 - 50% since 2000 thru carbon capture and sequestration activities
- Ammonium Sulfate – result of environmental system
- Urea - safer for handling and transporting
- Several years awarded BNSF Railway Product Stewardship
- Participate with the American Chemistry Council’s Responsible Care Program - received two awards
- Surrounding communities outreach - public meetings
- Reverse 911 system
Careers

• 730 employees
• Many career paths
• Field Technicians - Process Operations, Maintenance, Machine Shop
• Chemistry Lab - Chemists, Lab Technicians
• Engineering - every discipline - Chemical, Process, Mechanical, Electrical, Instrumentation, Civil, Reliability, Control Systems, Environmental
Careers

• Administrative Assistants for all areas
• Human Resources, Procurement, Marketing, Accounting, Payroll
• Medical Services - Doctor, Nurses
• Cafeteria staff
• Internships
• Student Cooperative Education Program
• Summer Work Program
Careers

- Works closely with area colleges
- Bismarck State College - Specific curriculum Power Plant, Process Plant, Mechanical Maintenance, Electrical & Instrumentation
- University of ND
- North Dakota State
- School of Mines
Come Visit Us

• Tours Tuesday through Thursday
• Brief video and scale model
• Call 701-873-2100
• Visit website - dakotagas.com
Questions