Lignite to SNG: An Innovative Success

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A Look at the Past

- Plant origin: ‘70s energy shortages
- $2.1 billion cost
- First Synthetic Natural Gas (SNG) produced in July 1984
- Dakota Gasification Company (DGC) began operating facility in 1988 as a subsidiary of Basin Electric Power Cooperative
Great Plains Synfuels Plant Today
Products

Naphtha

Carbon Dioxide

Anhydrous Ammonia

Liquid Nitrogen

Krypton/Xenon

Natural Gas

Cresylic Acid

Ammonium Sulfate

Phenols
Xenon/Krypton Gases

• Started in 1991

• Capacity of 3.5 million liters per year

• Used in:
  
  High-intensity halogen lighting
  
  Lasers
  
  Thermal pane windows
Lurgi Mark IV Gasifier
DAKOTA GASIFICATION PROCESS FLOW

COAL

LOCK GAS TO BOILER

GASIFIER

LOCK LOCK

Drying Zone

Carbonized Zone

Combustion Zone

OXYGEN PLANT

KRYPTON / XENON

LIQUID NITROGEN

OXYGEN

NITROGEN

BOILER STEAM

COAL BUNKERS

COAL

WASTE HEAT EXCHANGER

BOILER FEED WATER

STEAM TO PLANT STEAM SYSTEM

RAW GAS

GRAVITY SEPARATION

TAR OIL

BOILER LIQUOR

PRODUCT PURIFICATION

PHENOL

CRESYLC ACID

WATER TO COOLING TOWER

RAW GAS LIQUOR

CONDENSATED PROCESS WATER

CONDENSATION

NAPHTHA

RECTISOL UNIT (ACID GAS REMOVAL)

SYNTHESIS GAS

METHANATION

HIGH PRESSURE STEAM TO PLANT STEAM SYSTEM

PRODUCT GAS COMPRESSOR TO PIPELINE

CO2 PRODUCT TO PIPELINE

CO2, WASTE GAS

NAPHTHA

CO2 COMPRESSION

TO AMMONIA PLANT

BOILER FEED WATER

WASTE HEAT RECOVERY

STACK

AMMONIA

AMMONIUM SULFATE

PHENOL

CRESYLC ACID

RESPONSIBLE CARE

OUR COMMITMENT TO SUSTAINABILITY
Ammonium Sulfate

- Started in 1996
- Created to utilize the sulfur removed from the plant boiler flue gas in order to be compliant with the Clean Air Act of 1990
- Capacity to produce 60,000 tons per year
Phenol

- Started in 1990
- Capacity to produce 33 million lbs/yr
- Used in:
  - Plywood/OSB/Insulation
  - Countertops/Overlays/Exterior Siding
Cresylic Acid

- Started in 1990
- Capacity of 33 million lbs/yr
- Used in:
  - Pesticides/Insecticides
  - Wire enamel coatings
  - Resins
Rectisol
CO₂ and Sulfur Removal

Main Absorber

Purified Gas to Methanation

Feed Gas

Methanol

Flash Vessels
Naphtha

• Started in 1993

• Capacity of 8 million gallons per year

• Used as:

  Gasoline blend stock
  Paint thinner & other solvents
  Feedstock for benzene production
DAKOTA GASIFICATION PROCESS FLOW

COAL

LOCK GAS TO BOILER

GASIFIER

DRIED ZONE
CARBONIZED ZONE
ASHELLIZATION ZONE
OXYGEN PLANT

COAL BUNKERS

BOILER FEED WATER

STEAM TO PLANT STEAM SYSTEM

COOLED RAW GAS

CONDENSATION WATER

GRAVITY SEPARATION

TAR OIL

RAW GAS LIQUOR

PRODUCT PURIFICATION

PHENOL

PRESYLC ACID

WATER TO COOLING TOWER

CO2 PRODUCT TO PIPELINE

CO2 COMPRESSOR TO PIPELINE

HIGH PRESSURE STEAM TO PLANT STEAM SYSTEM

WASTE HEAT RECOVERY

PRODUCT GAS COMPRRESSOR TO PIPELINE

TO AMMONIA PLANT

RECTISOL UNIT (ACID GAS REMOVAL)

SYNTHESIS GAS

NAPHTHA

CONDENSATE WATER TO WATER TREATMENT

CO2 WASTE GAS

METHANATION

CO2 PRODUCT TO PIPELINE

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY
50% Total Reduction in CO₂ Emissions Since 1999!
CO$_2$ Compressors

- 19,500 hp compressors
- 55 million scf per day each
- 2700 psig discharge pressure
CO$_2$ Pipeline Crossing at Lake Sakakawea
Carbon Dioxide - 152 mmscfd

Used in Enhanced Oil Recovery
CO\textsubscript{2} Sequestration

- 2009 ~ 50% of DGC’s CO\textsubscript{2} captured & exported
- Through the end of 2009 – 11 million metric tons of CO\textsubscript{2} total net sequestered
- 2009 net sequestered was 66% of total sales
Through innovation & diversification the Great Plains Synfuels Plant is a financial success.