

# Enhancing Lignite's Future through R&D

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There is no challenge regarding the use of coal as a clean, efficient fuel that \_\_\_\_\_ been met by technology.

Nearly \_\_\_\_\_ of criteria pollutants from US coal-based power plants are now captured or reduced through the use of technology.

Over the last two years, coal use worldwide has \_\_\_\_\_.

Defined by Congress in the mid-1980s, \_\_\_\_\_ are technologies to reduce sulfur dioxide and nitrogen dioxides, or technologies that increase efficiencies and reduce emissions on a per unit energy basis.

The \_\_\_\_\_ is an industry/government partnership where for every state dollar, \_\_\_\_\_ dollars is invested from industry & other sources in lignite related R&D projects.

Consumption of North Dakota lignite can be broken down by:

- \_\_\_\_\_ Electric Power Generation
- \_\_\_\_\_ Synthetic Natural Gas
- \_\_\_\_\_ Specialty Products

\_\_\_\_\_ fired boilers use pulverized coal and are based on a concept of a single flame envelope and project both fuel and combustion air from the corners of the furnace. The flames are directed on a line tangent to a small circle lying in a horizontal plane at the center of the furnace. This action produces a fireball that moves in a cyclonic motion and expands to fill the furnace.

\_\_\_\_\_ use several water cooled horizontal burners to produce high temperature flames that circulate in a cyclonic pattern. The coal is not pulverized but instead crushed to a 4-mesh size. The crushed coal is fed tangentially, with primary air, to a horizontal cylindrical combustion chamber. In this chamber, small coal particles are burned in suspension while the larger particles are forced against the outer wall. The high temperature of the coal ash, causes the ash to form a molten slag, which is drained from the bottom of the furnace through a slag tap opening.

\_\_\_\_\_ technology uses air to suspend coal particles and an inert bed material. Burns at a significantly lower temperature which reduces the production of thermal NOx. The bed material can be an alkali or alkaline earth material that will capture SO2.

**Future generating technologies:**

- \_\_\_\_\_ – 3500 PSI Steam, Up to 1300 MW/Unit, 35-40% efficient, almost 17% reduction in CO2 and other emissions
- \_\_\_\_\_ – uses pure oxygen not air for combustion. This allows the flue gas to be basically CO2 and water and allows for different strategies for CO2 capture.
- \_\_\_\_\_ - chemical process that converts coal into a synthetic gas, this gas is used as a fuel. Highly efficient because the exhaust from the gas turbine is hot enough to boil water. The steam is then used to drive a turbine that creates a second source of electricity.
- \_\_\_\_\_ – refers to creating multiple products from coal
- \_\_\_\_\_ – uses supercritical CO2 as the working fluid and high pressure oxyfiring to release the chemical energy. Very high efficiency and capture 100% of the CO2.

**Gasification products:**

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- \_\_\_\_\_
- \_\_\_\_\_

\_\_\_\_\_ will gasify coal and convert it to ultra-clean gasoline, LPG, propane & electricity

\_\_\_\_\_ will gasify lignite and convert it to hydrogen for use in combustion turbine.

**Emission Control Technologies**

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\_\_\_\_\_ is the process of separating relatively pure carbon dioxide gas as a by-product of industrial processes and electricity generated from fossil fuels.

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