

Electricity Generation from Lignite

- Baseload sources – power is available for 24/7 demand, plants cost less to operate when at full efficiency
 - Examples:
 - Hydro dams
 - Nuclear plants
 - Coal-based generating stations
- Peaking plants – available when demand is highest, higher cost to operate, but quick start-up to react to demand changes
 - Examples:
 - Oil and natural gas-fired turbines
- Intermittent power sources – power is available when supply allows, unreliable
 - Examples:
 - Wind
 - Sun
- Lignite: a low-cost abundant resource for generation of electricity
- Every 4 megawatts of lignite-based electric generation requires about 3 jobs
- Magnetism is the fundamental science behind the production of electricity
- The movement of a magnet past a coil of wire is the basic concept behind the science of electricity generation
- It requires the same amount of electricity to light 20 incandescent light bulbs as it does to light up one LED bulb.
- The primary sources of energy for generation of electricity all use the same basic concept – a source of energy turns the blades on a shaft, which spins a magnet inside a coil of wire producing electricity
 - Thermal generations (coal-fired)
 - Nuclear generation (reactors)
 - Water (water wheel or water turbine)
 - Wind Generators (wind turbines)
 - Diesel (diesel engine)
 - Natural Gas (gas turbine)
- The most common method of generating electricity is using steam turbines with steam supplied from a coal fired boiler.
- Most lignite-fired stations pulverize the lignite into a fine powder and use hot air to carry the pulverized lignite to the burners in the boiler. The heat from burning the lignite generates steam which is used to drive a steam turbine which turns the generator.
- Lignite is delivered to the power plant by train or from the mine by truck and conveyed to the stockpile and into the plant.
- When the lignite burns in the furnace, the temperature is 2500 to 3000 degrees Fahrenheit.
- The steam in many boilers is around 2400 pounds per square inch

- North Dakota lignite is about 1/3 water. Converting a high moisture fuel like lignite to electricity uses about 35% of the total heat in the coal. By comparison, many internal combustion engines are less than 30% efficient.
- ND lignite coal's heating value is about 6,000 – 7,000 Btu/lb
- ND lignite coal has about 6-12% ash content and higher sodium and other mineral content, making it a more challenging fuel to burn.
- All North Dakota plants have technologies to control emissions
- Baghouses have large bags similar to vacuum bags to remove dust from boiler exhaust gasses
- Spray dryers with a baghouse are used to remove sulfur dioxide and flyash
- More North Dakota plants (98%) have scrubber capacity for removing sulfur dioxide than other parts of the country.
- North Dakota is one of only 7 states that meet all ambient air quality standards set by the Environmental Protection Agency.
- Types of generation
 - Baseload is power that's available 24-7 and includes coal-based electricity
 - Peaking facilities are generally fueled by natural gas and run sporadically to meet peak demands
 - Intermittent sources include wind and solar
 - Basin has some of each
- Generation choices
 - Nuclear – No CO2 emissions, relatively low cost generation – downside is radioactive waste
 - Hydro – No CO2 emissions, relatively low cost generation – downside is disruption of natural river flows
 - Natural gas has less emissions than coal but prices are volatile
 - Wind is renewable and has no emissions, but it's intermittent and requires back-up sources
 - Solar is renewable but is expensive and intermittent
 - Lignite is a low cost fuel but has a low BTU and high water content that makes shipping difficult. Federal regulations cause uncertainty.
- State electricity analysis
 - All six states – North Dakota, Minnesota, Iowa, South Dakota, Montana and Wyoming – have electricity prices below the national average
 - All rely to some extent on coal-based electricity which helps keep costs low.
- Low cost electricity from coal is important to families on fixed incomes and also important to economic development efforts.
- Resource planning is difficult because of the regulatory uncertainty surrounding coal.

Summary:

- Lignite is a low-cost, abundant resource for the generation of electricity that is beneficial for the region
- Lignite is a secure and reliable source of energy
- Lignite-based power plants are in compliance with all federal ambient air quality standards