REINHOLD ENVIRONMENTAL ®

2024 Reinhold/PCUG Round Table Presentation

Hosted by LG&E/KU and Co-hosted by Southern Co. and TVA

in The Marriott Resort Lexington Griffin Gate Hotel, Lexington, KY on June 24-25, 2024

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Reinhold Training Coal

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Introduction

- “The wonderful thing about knowledge is that you can give it away and still have it.” (Taylor, Dennis E. *Heaven’s River,* 2020).

- Matthew Wilson – TVA Pollution Controls Engineer

- Kelly Flanagan – TVA Fuels Assurance Sr. Manager

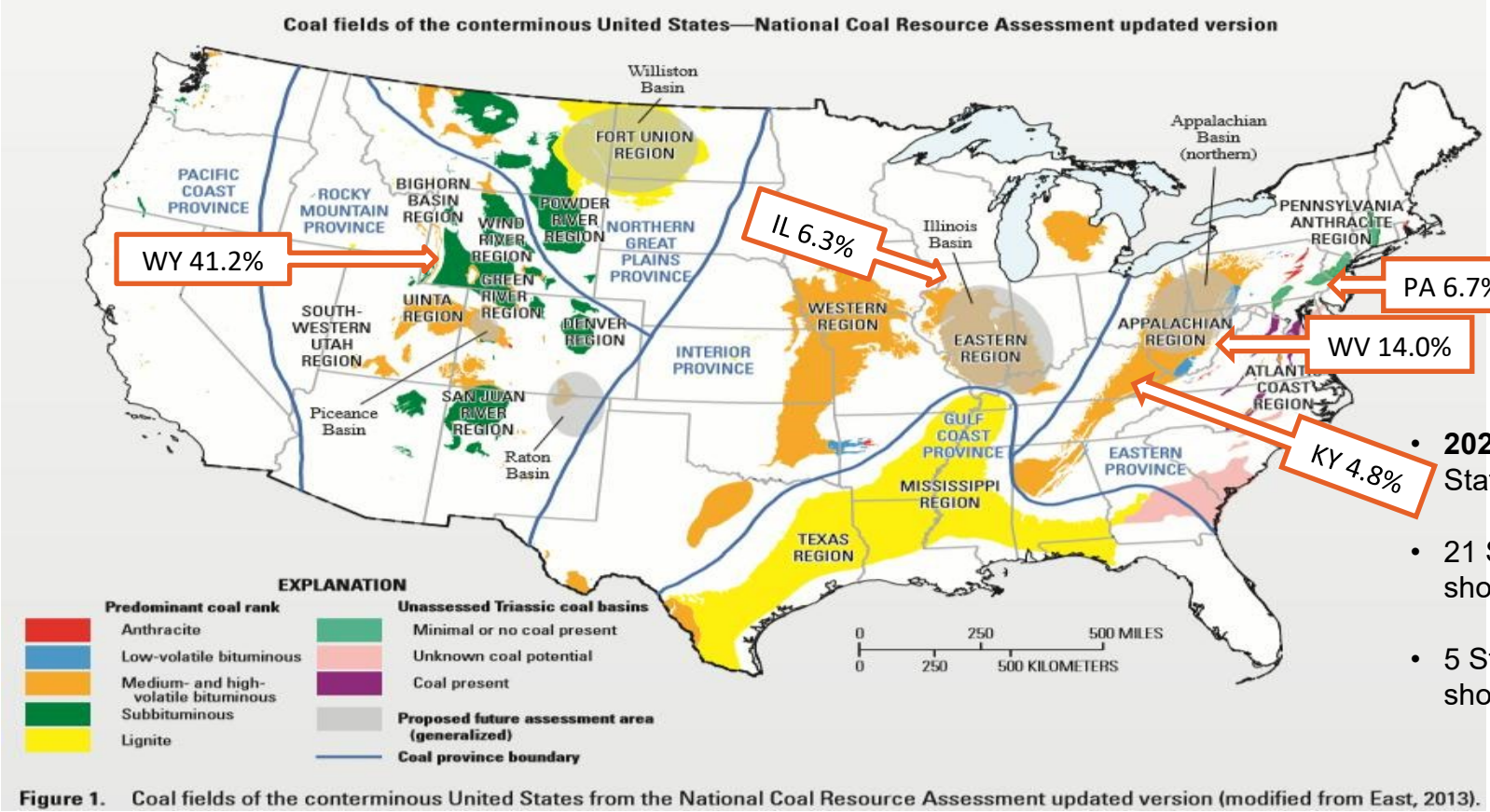

Figure 1. Coal fields of the conterminous United States from the National Coal Resource Assessment updated version (modified from East, 2013).

- **2022** Mined Coal Stats
- 21 States, 594M short tons
- 5 States, 434M short tons (73%)

Map Source: National Mining Association, January 10, 2022. https://nma.org/2022/01/10/coal-resources-of-the-united-states/

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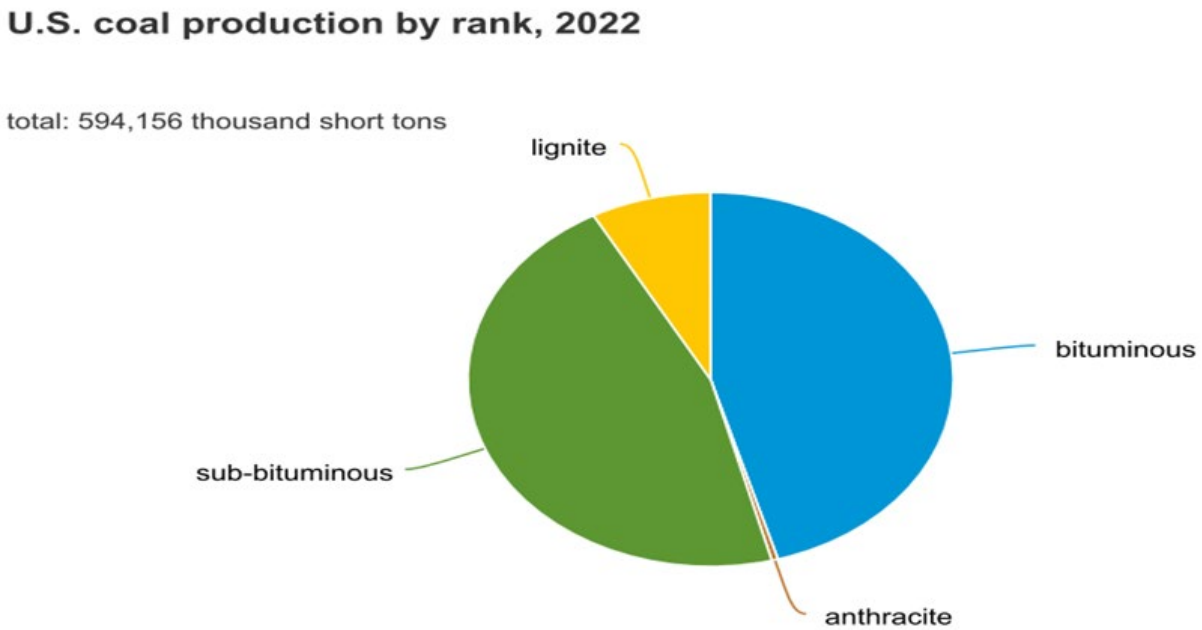
Coal Classification

- Ranked Classification by: carbon and heat energy
- Highest to Lowest:
- Anthracite –Metals & Domestic
- Bituminous – Thermal (electricity) & Coke (Metallurgical)
- Sub-bituminous – Thermal (electricity)
- Lignite –Thermal (electricity)

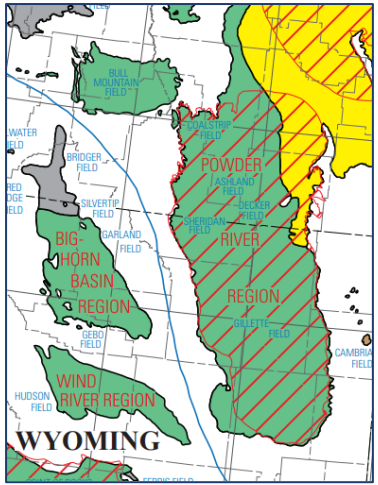


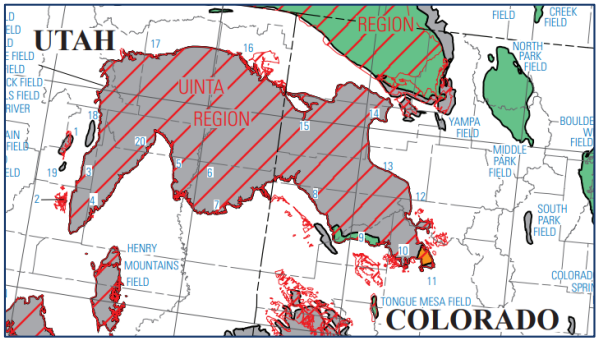
Graph Source: U.S.Energy Information Administration – Annual Coal Report Table 6 (2022)

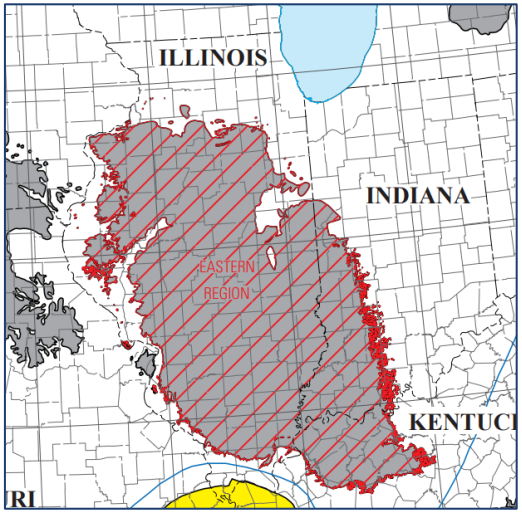
Common Challenges

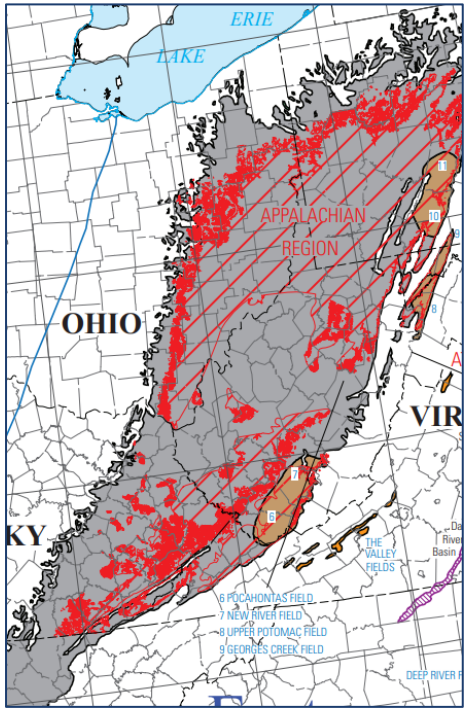
- Non-coal energy sources
- Viability of suppliers
- Shrinking mine options
- Transportation
- Stricter environmental regulations (mines and power plants)

TVA Focus Coal Basins – Advantages & Disadvantages









Source: East, J.A., 2013, Coal fields of the conterminous United States—National Coal Resource Assessment updated version: U.S. Geological Survey Open-File Report 2012–1205, one sheet, scale 1:5,000,000 [http://pubs.usgs.gov/of/2012/1205/

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Coal Selection Criteria

- Coal Price
- Transportation Cost and Reliability
- Coal Combustion Characteristics
- Coal Quality Constituents
- Unit Capacity Considerations
- Current Plant Pollution Controls
- Coal By-Products

TVA Fuel Blend Coordination

- TVA Lab and Third-party Labs
- Monthly Fuels Meeting
- Coal Blend and Review Process

Coal Quality and Constituent Testing

- ASTM - standardized procedures for sample preparation and analysis
- Certified Labs in North America adhere to ASTM standards, requiring regular equipment check, standard samples, and interlaboratory comparative testing.
- Proximate Analysis % (As Received) -**Moisture**, Ash, **Sulfur, BTU**, **SO2 Lbs/MMBtu**, Ash Lbs/MMBtu, Volatile Matter, Fixed Carbon
- Ultimate Analysis % (Dry Basis) - **Ash**, Hydrogen, Carbon, Nitrogen, Sulfur, Oxygen
- Ash Mineral Analysis % (Ignited Basis) - Many oxides. Highlights: **Calcium Oxide, Iron Oxide**
- Ash Fusion Temperatures (Fahrenheit) – Reducing, Oxidizing with Highlight of **Softening Temp.**
- Trace Elements (Dry Basis PPM) – Highlights: **Arsenic, Chlorine, Mercury, Selenium, Fluorine**
- Other Info - Highlights: **Hard Grove Grindability Index, Volatile Matter (Dry Basis %), & Chlorine (Dry Basis %)**

Pollution Control Equipment Considerations

- SCRs – Arsenic, Ash, Calcium Oxide, Sulfur
  - Catalyst Supplier Fuel Impact Chart
  - Arsenic increases increasing impacts with elevated sulfur %. Months to Years less of catalyst life possible
  - Too high a calcium oxide can negatively impact catalyst life
- MATS – Sulfur
  - Scrubber Designs, HCl Surrogate of SO2, dry or wet scrubber consideration
  - Reagent demand – dry scrubbers especially. Fuel blend changes, reagent ordering and onsite storage
- NOX and Good Neighbor Regulations

Pollution Control Equipment Considerations

- MATS – Cl, BTU, Ash % and Ash Split
  - Without a scrubber, Cl drives dry sorbent injection (DSI). <30 dry Cl ppm proven on both Pptr and RGFF equipped units without DSI.
  - BTU, Ash, and flue gas volume: Decreasing BTU = more flue gas volume for same boiler heat input. Ash *generally* comes with higher BTU and Sulfur.
  - All major Pollution Controls - strong performance function actual gas velocity; hi and lo ends.
  - Ash split with Bituminous Fuel generally 80% bottom ash and 20% flyash. Sub-bituminous Opposite - Impacts: bottom ash equipment systems, dry flyash particulate removal systems

Learn More About Coal Mining

- Search some of these methods for explanations, pictures, and graphics
  - Surface Mining: Strip Mining, Open-Pit Mining, Mountaintop Removal
  - Underground Mining: Room and Pillar Mining, Longwall Mining
- www.eia.gov U.S. Energy Information Administration


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