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U.S. Coal Resources and Reserves Assessment Project

Assessing U.S. Coal Resources and Reserves

The U.S. Coal Resources and Reserves Assessment Project, as part of the U.S. Geological Survey (USGS) Energy Resources Program, conducts systematic, geology-based, regional assessments of significant coal beds in major coal basins in the United States. These assessments detail the quantity, quality, location, and economic potential of the Nation's remaining coal resources and reserves and provide objective scientific information that assists in the formulation of energy strategies, environmental policies, land-use management practices, and economic projections.

Introduction

The U.S. Energy Information Administration (EIA) projects that approximately 30 percent of the electricity used in the United States will be generated from coal over the next several years and that coal will continue to be a major fuel source for the generation of electricity into the foreseeable future (U.S. Energy Information Administration, 2017b). The coal resources and reserves of the Nation that will supply the continued demand occur in numerous coal beds and coal zones, of varying thickness, rank, areal extent, and quality in coal fields and basins throughout the United States (fig. 1). To determine if the Nation's coal resources and reserves are sufficient to meet the projected future demands, periodic objective and scientific assessments of these coal resources and reserves are required.

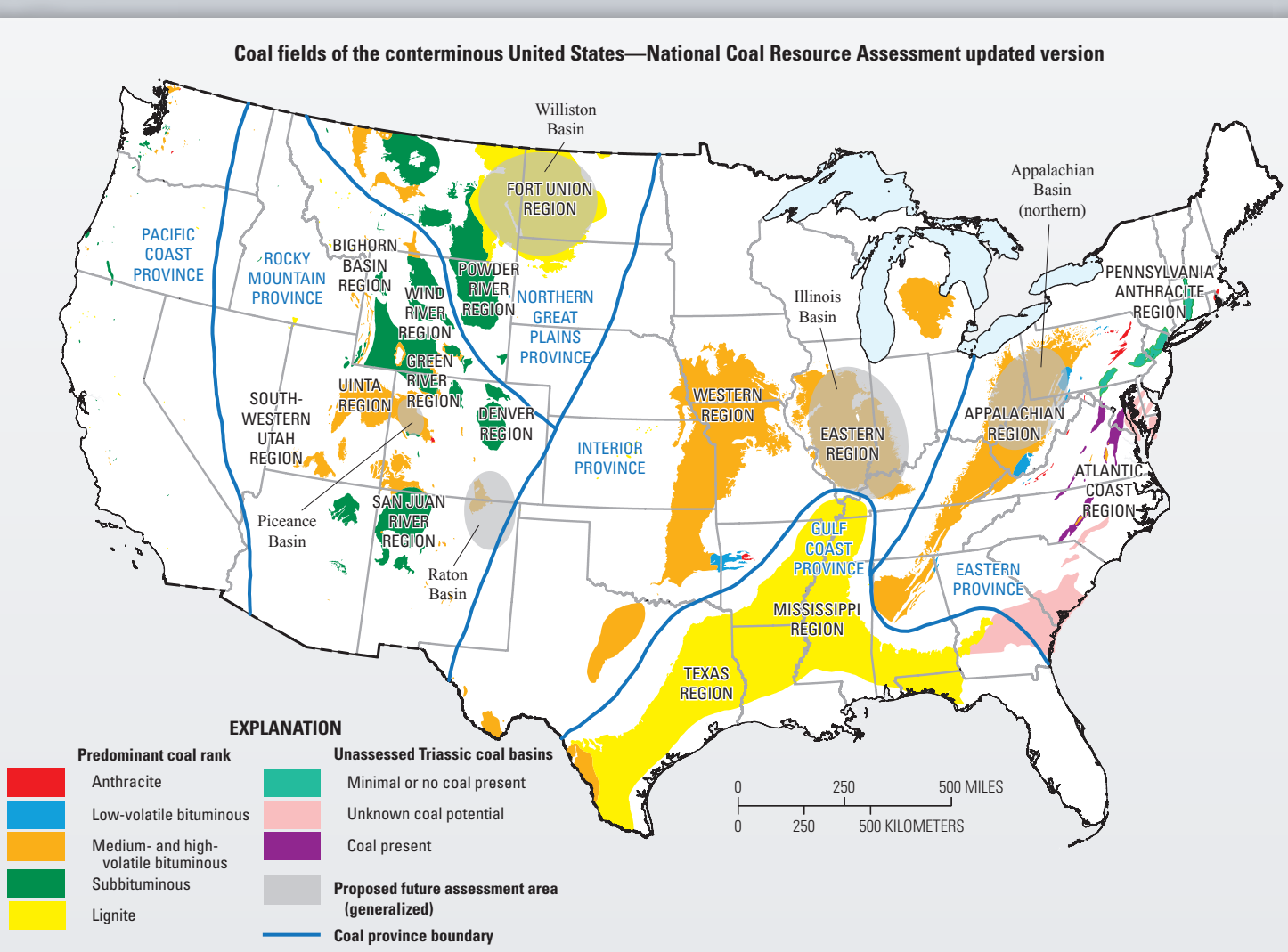

Figure 1. Coal fields of the conterminous United States from the National Coal Resource Assessment updated version (modified from East, 2013).

Resources Versus Reserves

The United States is richly endowed with coal resources, although only a small percentage of these coal resources can be defined as reserves. The terms "resources" and "reserves" are often used interchangeably, but there are major differences in their definitions. The terms, modified from USGS Circular 891 (Wood and others, 1983, p. 18–19), are defined as follows:

- *Coal resources* are naturally occurring deposits of coal in the Earth's crust in such amounts that economic extraction is currently or potentially feasible.
- *Coal reserves* are the portion of the recoverable coal resources that can be extracted economically at the time of classification, even if the facilities for extraction are not in place or operative at the time of classification.

Coal resources can be classified into categories that are progressively refined; this categorization reduces coal quantities using criteria such as previous mining, geologic conditions, environmental restrictions, and mining-technology limitations. As these criteria are applied, the quantity of coal resources available in each category is reduced. An explanation of the categories and the criteria affecting coal quantity losses that the USGS calculates are shown in figure 2.

The portion of recoverable coal resources that can be defined as reserves by the USGS will vary over time on the basis of fluctuations in mining costs and the market value of the coal. In order to be classified as economically extractable, the current market value of the extracted coal must be greater than the cost to extract it. The projected costs of extraction are calculated by compiling economic-model designs based on regional mining practices and prefeasibility cost projections.

As an example, the projected tonnage values for each coal resources category and the total reserves that the USGS calculated for the Powder River Basin (Luppens and others, 2015) are shown in table 1. Note that the reserves are only a small percentage of the original coal resources. Estimating the recoverable coal resources and reserves provides a more accurate and relevant assessment of the U.S. coal resources that are realistically available for extraction into the foreseeable future using current technology.

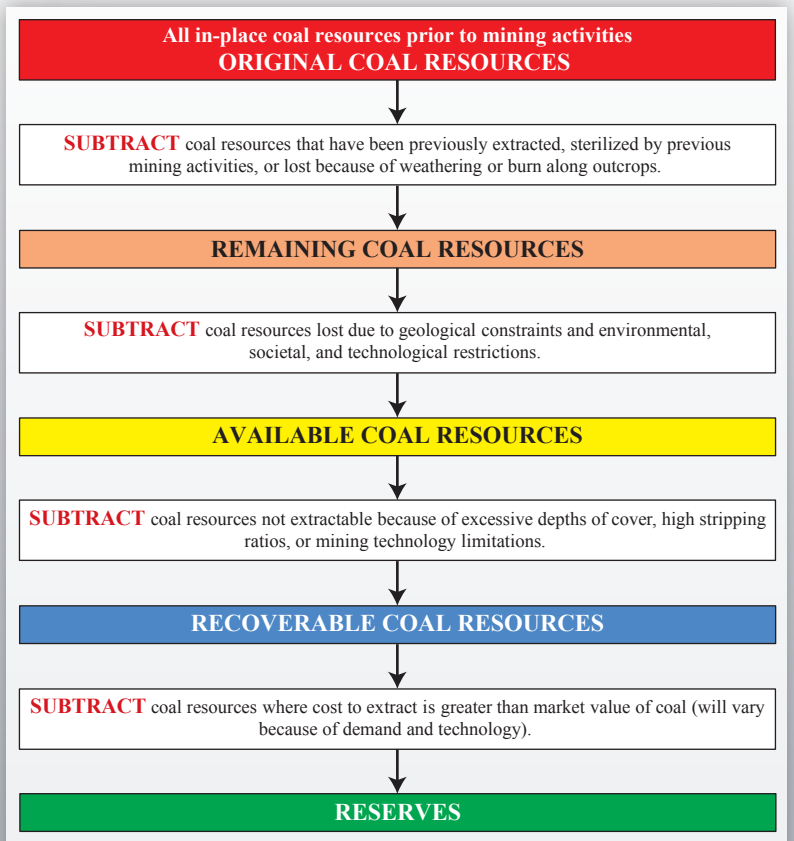

Figure 2. Flow chart for the classification of coal resources and reserves (modified from Luppens and others, 2009).

Table 1. Powder River Basin (Wyoming and Montana) coal resources and reserves showing the percent of each classification as compared to the original resources (tonnage values from Luppens and others, 2015).

Powder River Basin Coal Resources and Reserves			
Assessment classification	**Factors**	**Tons (billions of short tons)**	**Percent of original resources**
Original resources		**1,156**	**100%**
	SUBTRACT Previously mined or sterilized; Weathering or burn along outcrops		
Remaining resources		**1,148**	**99%**
	SUBTRACT Geological constraints; Environmental, societal, technological restrictions		
Available resources		**179**	**15%**
	SUBTRACT Too deep; Too thin; High stripping ratios; Mining technology limitations		
Recoverable resources		**162**	**14%**
	SUBTRACT Cost to extract is greater than market value of coal		
Reserves		**25**	**2%**

Objective and Scope

The objective of the U.S. Coal Resources and Reserves Assessment Project is to conduct systematic, geology-based, regional assessments of the Nation's remaining coal resources, as well as recoverable coal resources and reserves for individual, significant coal beds in major coal provinces and regions. "Significant coal beds" are defined as laterally extensive and of sufficient thickness to warrant assessment as coal resources and (or) reserves.

The current coal assessment project differs from previous generations of USGS coal assessments in that

- Current assessments report tonnages for all coal resources classifications, as well as for reserves, whereas previous assessments only reported total coal resources or remaining coal resources;
- Current assessments of coal resources and reserves are conducted for basins or coal fields within basins, whereas previous assessment areas ranged in size from geographic regions or coal provinces down to USGS 7.5-minute quadrangle scale; and
- Current assessments focus on individual, significant coal beds, whereas some previous assessments focused on composite intervals or zones containing multiple coal beds.

The current objective of the project is to assess coal resources and reserves in the Northern Great Plains and Rocky Mountain Coal Provinces (fig. 1), with an emphasis on coal underlying Federal lands. The first coal basin evaluated, using the individual, significant coal bed methodology, was the Powder River Basin in Wyoming and Montana (Luppens and others, 2015).

The Greater Green River Basin in Wyoming and Colorado is the second basin under assessment (fig. 3). The assessment is focused in three separate areas:

1. Little Snake River coal field and Red Desert (south-central Wyoming)
2. Yampa coal field (northwestern Colorado)
3. Rock Springs uplift (southwest Wyoming)

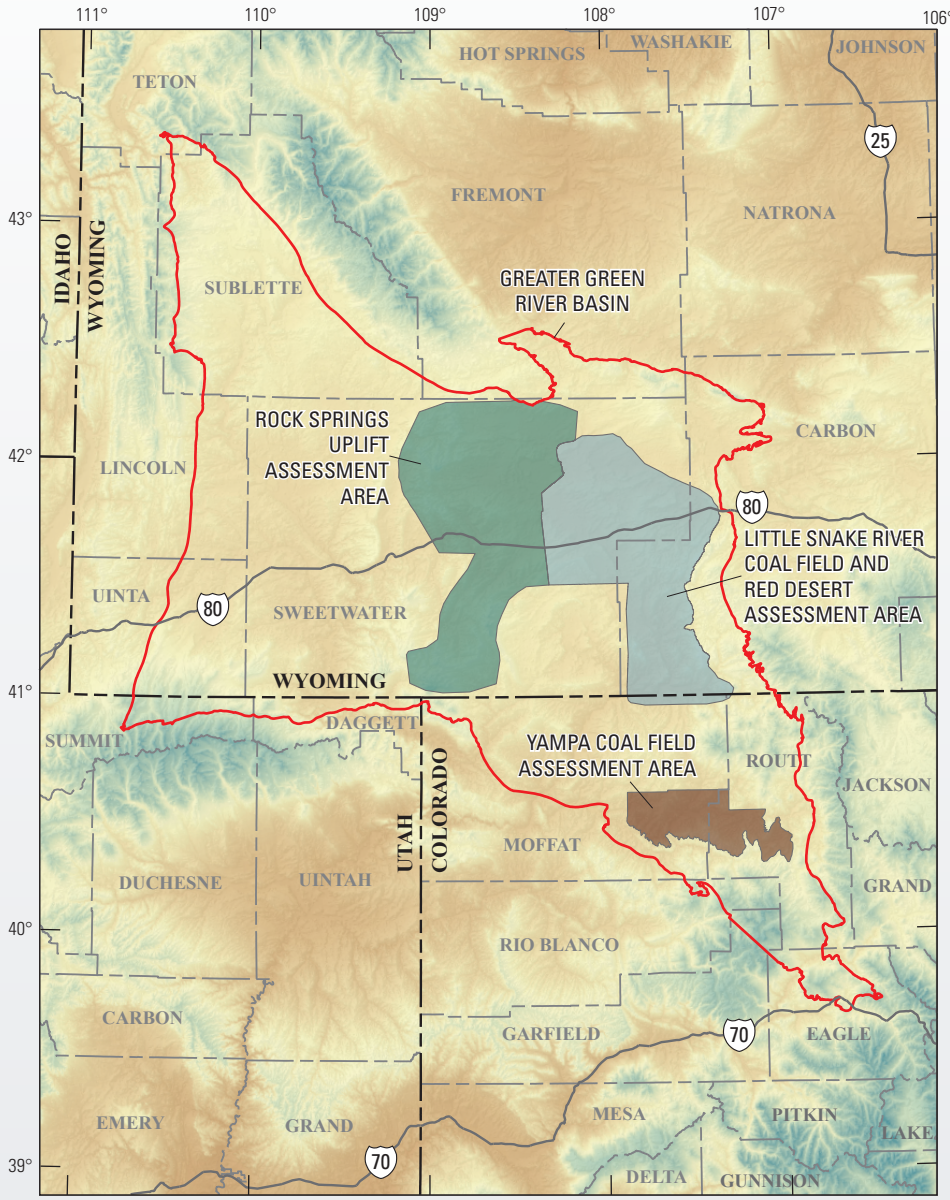

Figure 3. U.S. Coal Resources and Reserves Assessment Project current assessment studies in the Greater Green River Basin, Wyoming and Colorado. Outline of Greater Green River Basin from U.S. Geological Survey Southwestern Wyoming Province Assessment Team (2005).

The Greater Green River Basin was prioritized for assessment because it contains vast tracts of Federal lands and large areas of the basin have not been formally assessed by the USGS for coal resources and reserves. For example, in the Little Snake River coal field and Red Desert assessment area, approximately 58 percent of the surface land is owned by the Federal Government (U.S. Geological Survey, 2000).

Additionally, much of the drill hole data that is being used in the geologic modeling and economic evaluations in the Greater Green River Basin was acquired by the USGS within the last 5 years and provides an increased data density within the assessment areas.

Areas under consideration for future assessments include the Raton and Piceance Basins in the Rocky Mountain Province and the Williston Basin in the Northern Great Plains Province (fig. 1). Also under consideration for assessment are the Illinois Basin, the northern Appalachian Basin, and the Gulf Coast Province. These areas warrant consideration for assessment because they will continue to provide substantial amounts of the coal produced in the United States in the foreseeable future (U.S. Energy Information Administration, 2017a).

Methodologies

The systematic determination of recoverable coal resources and reserves conducted by the U.S. Coal Resources and Reserves Assessment Project uses a peer-reviewed methodology based on established USGS practices (Rohrbacher and others, 2005). The assessment methodology can be divided into three distinct phases:

- Phase 1—Data collection: Geologic, coal quality, restrictions, and economic data are collected and organized.
- Phase 2—Data modeling: Significant coal beds are correlated and modeled.
- Phase 3—Calculations: Geologic and economic models are evaluated and resources and reserves are calculated.

The USGS works cooperatively with Federal and State agencies, including State geological surveys and the Bureau of Land Management in data sharing, correlations, and geologic interpretations.

Results

The results of the coal assessments provide essential information on the quantity, quality, and availability of coal resources and reserves remaining in the United States. This information is used in academia and industry and by a variety of Federal and State agencies and contributes to the formulation of energy strategies, environmental policies, land-use management practices, and economic projections.

Selected U.S. Coal Resources and Reserves Assessment Project Publications

- Preliminary Geologic Mapping of Cretaceous and Tertiary Formations in the Eastern Part of the Little Snake River Coal Field, Carbon County, Wyoming (Haacke and others, 2016)
- Coal Geology and Assessment of Coal Resources and Reserves in the Powder River Basin, Wyoming and Montana (Luppens and others, 2015)
- Geospatial Data for Coal Beds in the Powder River Basin, Wyoming and Montana (Kinney and others, 2015)
- Drill Hole Data for Coal Beds in the Powder River Basin, Montana and Wyoming (Haacke and Scott, 2013)
- Assessment of Coal Geology, Resources, and Reserve Base in the Powder River Basin, Wyoming and Montana (Scott and Luppens, 2013)
- Assessment of Coal Geology, Resources, and Reserves in the Montana Powder River Basin (Haacke and others, 2013)
- A Critical Review of Published Coal Quality Data from the Southwestern Part of the Powder River Basin, Wyoming (Luppens, 2011)
- Assessment of Coal Geology, Resources, and Reserves in the Southwestern Powder River Basin, Wyoming (Osmonson and others, 2011)
- Assessment of Coal Geology, Resources, and Reserves in the Northern Wyoming Powder River Basin (Scott and others, 2011)
- Assessment of Coal Geology, Resources, and Reserves in the Gillette Coalfield, Powder River Basin, Wyoming (Luppens and others, 2012)

Panoramic view of surface mine operation in the Powder River Basin, Wyoming. (Photo by David C. Scott)

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Loading coal at the Trapper Mine, northwest Colorado. (Photo by David C. Scott)

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For More Information

Coal assessment results also are available at the USGS Energy Resources Program website at https://energy.usgs.gov/.

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A train loaded with coal leaves the Powder River Basin, Wyoming. (Photo by David C. Scott)

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