Energy Map of Southwestern Wyoming, Part A—Coal and Wind

Data Series 683

U.S. Department of the Interior
U.S. Geological Survey

Cover. Top: Naughton power plant near Kemmerer, Wyo. (photograph by L.R.H. Biewick, 2011).
Bottom: Seven Mile Hill wind project (used with permission from Jeff Hymas, 2012, PacifiCorp).

Energy Map of Southwestern Wyoming, Part A—Coal and Wind

By Laura R.H. Biewick and Nicholas R. Jones

Data Series 683

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2012

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment, visit http://www.usgs.gov or call 1–888–ASK–USGS.

For an overview of USGS information products, including maps, imagery, and publications, visit http://www.usgs.gov/pubprod

To order this and other USGS information products, visit http://store.usgs.gov

Suggested citation:
Biewick, L.R.H., and Jones, N.R., 2012, Energy map of southwestern Wyoming, Part A—Coal and wind: U.S. Geological Survey Data Series 683, 18 p. pamphlet, 5 pls. [Available at http://pubs.usgs.gov/ds/683/].

Contents

Figures

Tables

Plates

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
	Area	
acre	4,047	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Mass	
ton, short (2,000 lb)	0.9072	megagram (Mg)
ton, long (2,240 lb)	1.016	megagram (Mg)
	Energy	
kilowatthour (kWh)	3,600,000	joule(J)
Megawatt (MW)	1,000	kilowatt (kW)

Energy Map of Southwestern Wyoming, Part A—Coal and Wind

By Laura R.H. Biewick[1] and Nicholas R. Jones[2]

Abstract

The U.S. Geological Survey (USGS) and the Wyoming State Geological Survey (WSGS) have compiled Part A of the Energy Map of Southwestern Wyoming for the Wyoming Landscape Conservation Initiative (WLCI). The WLCI represents the USGS partnership with other Department of the Interior bureaus, State and local agencies, industry, academia, and private landowners committed to maintaining healthy landscapes, sustaining wildlife, and preserving recreational and grazing uses while developing energy resources in southwestern Wyoming. This product complements the 2009 and 2011 USGS publications on oil and gas development in southwestern Wyoming (*http://pubs.usgs.gov/ds/437/*), and the entire state of Wyoming (*http://pubs.usgs.gov/ds/625/*) by adding coal, including coalbed methane, and wind energy development in the area within the WLCI. Part A of the Energy Map is concerned primarily with the electrical power sources of coal and wind.

The expanded boundaries of the WLCI encompass all of Carbon, Lincoln, Sublette, Sweetwater, and Uinta Counties, Wyoming, as well as areas in Fremont County, Wyoming, that are in the Great Divide and Green River Basins. With updated oil and gas data, other energy resources across southwestern Wyoming, including oil shale, uranium, and solar, are planned for inclusion in Part B of the Energy Map.

Introduction

To further advance the objectives of the Wyoming Landscape Conservation Initiative (WLCI) the U.S. Geological Survey (USGS) and the Wyoming State Geological Survey (WSGS) have compiled Part A of the Energy Map of Southwestern Wyoming. Focusing primarily on electrical power sources, Part A of the energy map is a compilation of both published and previously unpublished coal (including coalbed gas) and wind energy resources data, presented in a Geographic Information System (GIS) data package. Data are included from U.S. Geological Survey (USGS) coal and coalbed gas assessments (see references on pl. 1, 2, 3 and 4), an updated coal map of Wyoming (Jones and others, 2009), geology and coal stratigraphy of the Rawlins-Little Snake River area (Hettinger and others, 2008), a coalbed natural gas map of the Atlantic Rim (Quillinan and others, 2009), and spatial mapping and attribution of Wyoming wind turbines (O'Donnell and Fancher, 2010). In addition, National Coal Resource Data System (NCRDS) stratigraphic data, coalbed gas wells from the Wyoming Oil and Gas Conservation Commission (WOGCC), and Bureau of Land Management (BLM) authorized and pending coalbed gas units are included. Energy maps, data, documentation and spatial data processing capabilities are available in a geodatabase (ESRI, 2012), published map file (PMF; ESRI, 2008b), ArcMap document (MXD; ESRI, 2000), Adobe Acrobat PDF map (Adobe Systems Incorporated, 2010, pl. 1) and other digital formats that can be downloaded at the USGS website.

Accompanying the map (pl. 1) and the geospatial data are four additional plates that describe the geology, energy resources and related infrastructure. These tabular plates include coal mine (pl. 2), coal field (pl. 3), coalbed gas assessment unit (pl. 4), and wind farm (pl. 5) information with hyperlinks to source publications and data on the internet. The plates can be printed and examined in hardcopy or accessed digitally in Excel (Microsoft, 2007) and as Adobe PDF files. The data represent decades of research by the USGS, WSGS, BLM, private industry, and others and can facilitate landscape-level science assessments, and resource management decisionmaking.

Coal

The sedimentary basins in Wyoming contain some of the largest fossil fuel deposits in the United States (U.S. Energy Information Administration (EIA), 2010). These basins developed throughout the Late Cretaceous–early Tertiary Periods during the Laramide Orogeny (fig. 1).

Throughout much of the Cretaceous Period, a good portion of the area that is today Wyoming, was at or near sea level. The climate was tropical to subtropical and temperatures were warmer, as evidenced by fossils in the rock record. A vast seaway occupied the Western Interior of North America, connecting the Circum-Boreal Sea with the proto-Gulf of

[1]U.S. Geological Survey
[2]Wyoming State Geological Survey

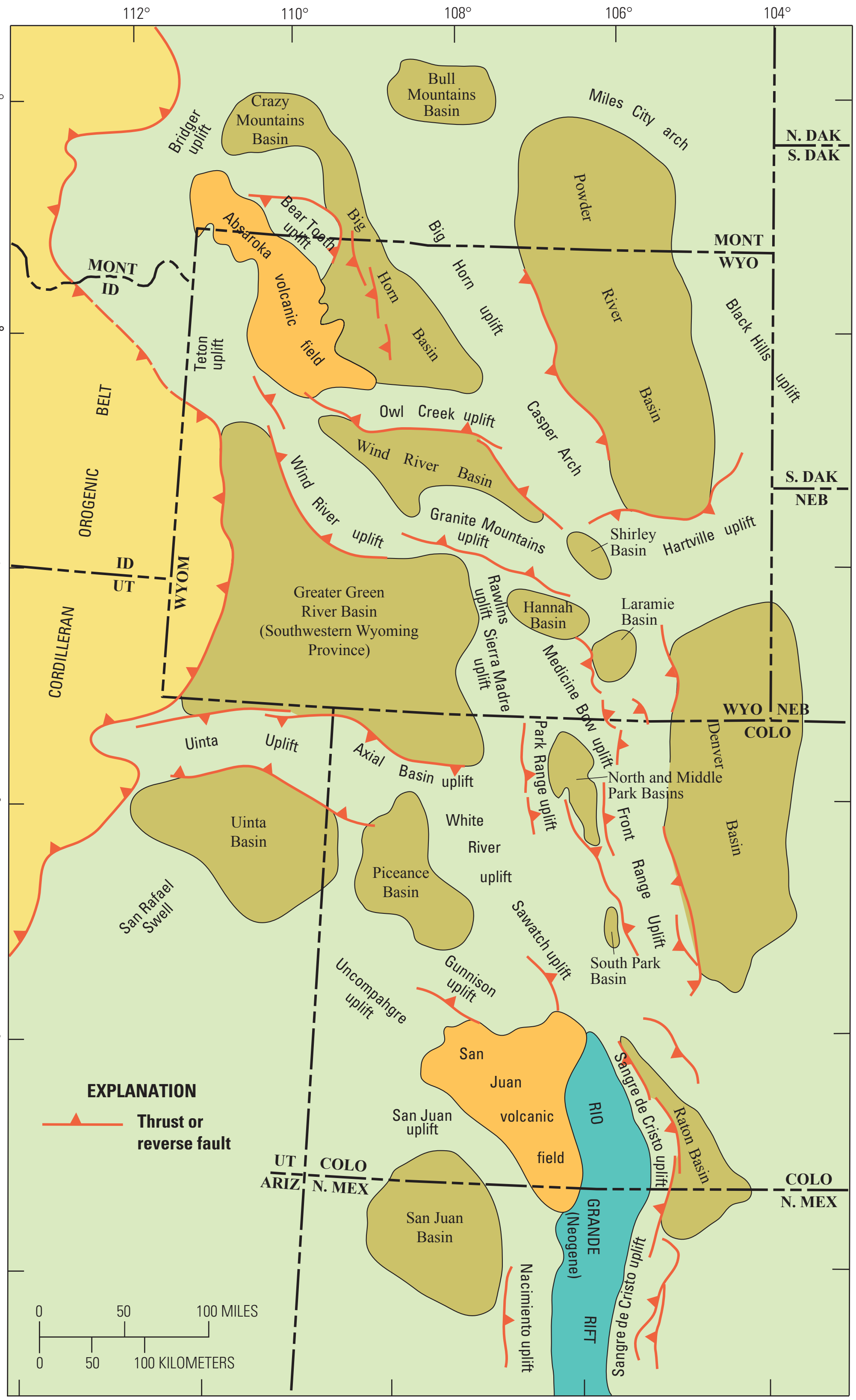

Figure 1. Laramide sedimentary and structural basins and intervening uplifts in the Rocky Mountain region extending from southern Montana to northern New Mexico. Modified from Dickinson and others (1988) *in* Finn and Johnson (2005).

Mexico (Roberts and Kirschbaum, 1995). The body of water is known most commonly as the Western Interior Cretaceous Seaway. During the Late Cretaceous and into the early Tertiary, regional uplift forced the interior of the United States to rise, causing the epeiric sea to migrate to the northeast, thus severing the connection between the Arctic Sea and the Gulf of Mexico. Vegetation grew in coastal wetlands bordering the seaway from about 98 to 70 million years ago (fig. 2), and extensive coal deposits accumulated in lower coastal plain depositional settings (Johnson and others, 2005; Finn and others, 2005).

Over time, the seaway retreated, and marine and coastal-plain environments became restricted to areas north and east of Wyoming, in what is now North and South Dakota. During the Paleocene Epoch (about 65 to 56 million years ago), wetlands in Wyoming developed in low lying floodplains and along fluvial corridors (fig. 3).

Over geologic periods of time, the accumulation of organic material derived from these wetlands formed peat. Uplift during the Laramide Orogeny divided the area into structural basins and intervening highlands (fig. 1). Great volumes of erosional debris were carried from the uplands by rivers and streams, and deposited in the subsiding basins. These sediments buried and preserved the organic material, where it eventually was transformed into coal. Coalification is a slow two-phase process; the first (biogenesis) is the bacterial decay of plant matter. The second, heat-driven phase (thermogenesis) is a function of temperature, as maintained by the insulating effect of thick layers of sediment above the proto-coal through time (millions of years), (Jones, 2009).

In Wyoming, coal was initially discovered in 1843 by the Fremont Expedition. Commercial mining began with the arrival of the railroad in the 1860s. The first commercial mines were located in Carbon and Rock Springs, where large amounts of coal were needed to power steam engines for the railroad (U.S. BLM, 2008a). Today, coal is used to generate about 50 percent of our nation's electricity, and coal-fired power plants dominate Wyoming electrical generation (U.S. EIA, 2010). Within the WLCI, there are several active surface coal mines in the Hams Fork, Green River and Hanna coal fields (pls. 1, 2, and 3). Some of the coal mines are no longer active and have been abandoned or reclaimed. For the former Rosebud Mine in the Hanna Basin, what began as a voluntary revegetation program in 1965, evolved into the complete reclamation of 4,000 acres (©Kiewit, 2010). The only active underground coal mine is currently the Jim Bridger longwall operation on the east flank of the Rock Springs uplift.

Some coals contain enough gas to be potentially economic. Coalbed methane (CBM) is natural gas that formed in coal deposits during and after the coalification process. CBM, also referred to as coalbed gas or coalbed natural gas (CBNG), is used for a variety of purposes ranging from domestic heating to commercial electrical power generation (WSGS, 2010a). Evidence for the occurrence of CBM includes direct measurements in wells and coal cores, gas-related explosions and fires in underground coal mines, inferences from the rank of coal, surface venting of gas, and thermal histories of coal fields (DeBruin and others, 2004). According to WSGS geologist Scott Quillinan, "CBNG activity in the area southwest of Rawlins started in 2000 with a handful of exploratory wells. As of November, 2009, there were 676 wells drilled. Of these, 277 were producing CBNG." (WSGS, 2010b; pl. 1). For the Atlantic Rim area, the BLM has approved 2,000 wells—1,800 for CBM and 200 for conventional natural gas (WSGS, 2010b).

In 2002 and 2003, the USGS assessed coalbed gas resources in the Southwestern Wyoming and the Wyoming Thrust Belt Provinces. Using a geologic-based assessment methodology, the USGS estimated a mean of 1.89 trillion cubic feet (TCF) of undiscovered coalbed gas in seven coalbed gas assessment units (AUs), six in the Southwestern Wyoming Province (Kirschbaum and others, 2002) and one in the Wyoming Thrust Belt Province (pl. 4; Kirschbaum and others, 2004). Although these AUs extend beyond the boundary of the WLCI, 74 percent of the area covered by these AUs is within the WLCI.

Wind

Because national and regional forecasts project an increase in consumption of electrical energy continuing into the foreseeable future, renewable energy, including wind generation, is expected to provide a larger component to maintain adequate electrical power (U.S. BLM, 2010b). One of the most favorable locations for wind power development in the Nation is located in southern Wyoming. Across southern Wyoming from the Utah border on the west to the Nebraska border on the east, a gap in the Rocky Mountains channels strong winds generated from across the plains, making this area ideally suited for wind power development (U.S. EIA, 2010, and fig. 4). In the 1986 Wind Energy Resource Atlas of the United States (Elliott and others, 1986), the Solar Energy Research Institute (now the National Renewable Energy Laboratory), reported that in this 150-km (90 mi)-wide gap, areas of highest wind are where there is enhanced channeling by the terrain (for example, between two mountain ranges) and (or) where there is terrain-induced flow acceleration (for example, over hilltops, uplands, or low ridges).

In 2010, the U.S. Department of Energy's Wind Program and the National Renewable Energy Laboratory (NREL) published a wind resource map for the state of Wyoming (U.S. Department of Energy and AWS Truepower, 2010; fig. 4). The wind resource map shows the predicted mean annual wind speeds at an 80-meter (m) height, presented at a spatial resolution of about 2 km. Areas with annual average wind speeds around 6.5 m/s and greater at an 80-m height are generally considered to have a resource suitable for wind development. Utility-scale, land-based wind turbines are typically installed between 80-100 meters (U.S. Department of Energy and AWS Truepower, 2010). NREL estimated the windy land area and

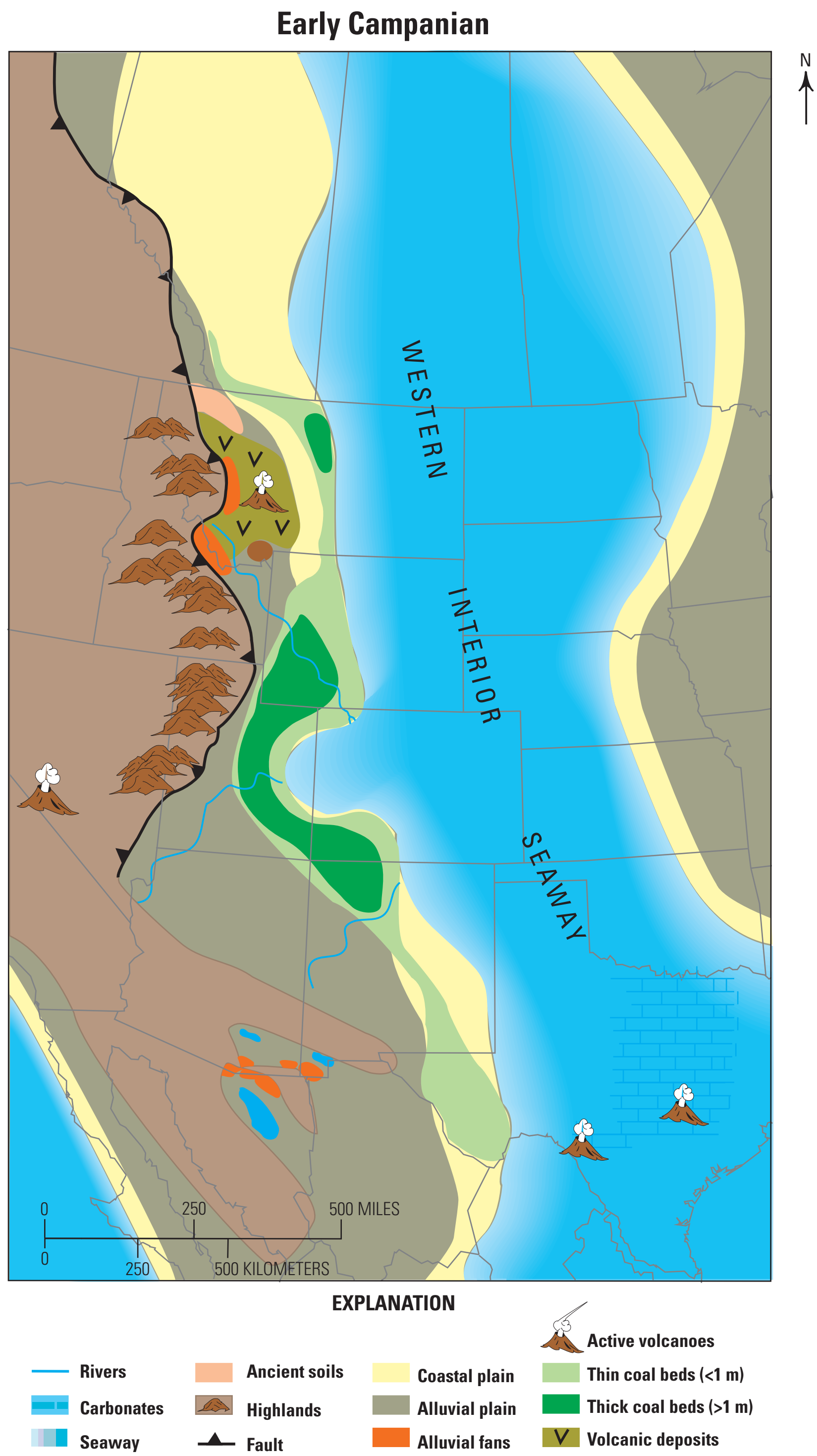

Figure 2. Paleogeographic reconstruction of the Cretaceous Western Interior Seaway during the Late Cretaceous (modified from Roberts and others, 1995; Roberts and Kirschbaum, 1995).

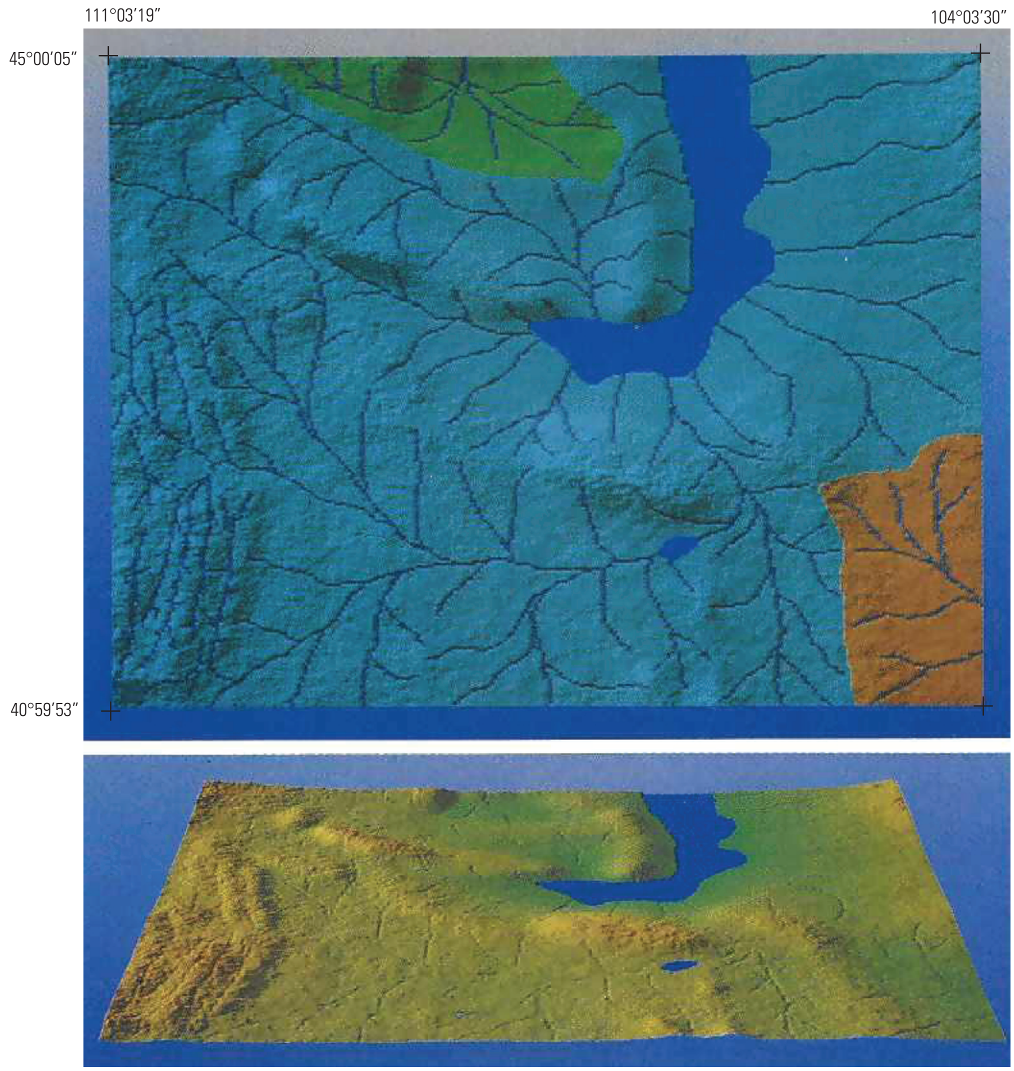

Figure 3. Late early Paleocene hydrographic basins (top) and interpretive paleotopography (bottom) in Wyoming. The large lake system probably drained northward into ancient Montana. Most of the area drained northward (Lillegraven and Ostresh, 1988).

wind energy potential in various capacity factor ranges for each state using AWS Truepower's gross capacity factor data. Maps and wind potential estimates for the state of Wyoming are available at the U.S. Department of Energy's Wind Powering America website at *http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=wy*.

One large area of exceptionally good wind energy potential extends from the Rawlins area eastward to Medicine Bow and then south along the Laramie Mountains to the Colorado border (fig. 4; Elliott and others 1986). In the expansive treeless plateau between Laramie and Rawlins, Foote Creek Rim is one of the windiest places in America, with average wind speeds of 25 mph; 25–70 percent windier than other good wind sites (see pls. 1, 5; U.S. BLM, 2008b). The Foote Creek Rim Wind Farm, near Arlington, was the first commercial wind farm to go online in Wyoming, beginning operations in 1999 (U.S. BLM, 2008b). In extreme southwestern Wyoming, wind measurements at Bridger Butte, near Fort Bridger, showed class 6 annual average wind power at heights to 50 m (164 ft). Areas designated class 3 or greater are suitable for most wind turbine applications; fig. 4, Elliott and others, 1986. Two wind farms on Bridger Butte, Mountain Wind I and Mountain Wind II, began operations in 2008 (©PacifiCorp, 2010, pl. 1 and 5). Winter is the season of maximum wind power, with class 7 (the highest) power in the best areas. In summer, the season of minimum wind power, class 3 power can be expected in the best areas (Elliott and others, 1986).

Seven current wind farms operating in southwestern Wyoming are producing about 674 megawatts (MW) from approximately 504 wind turbines (pls. 1, 5). Five additional wind energy projects are proposed, in progress or under construction, and may add as many as 1,639 additional wind turbines capable of producing 2,700 to 3,700 MW of energy (pls. 1, 5).

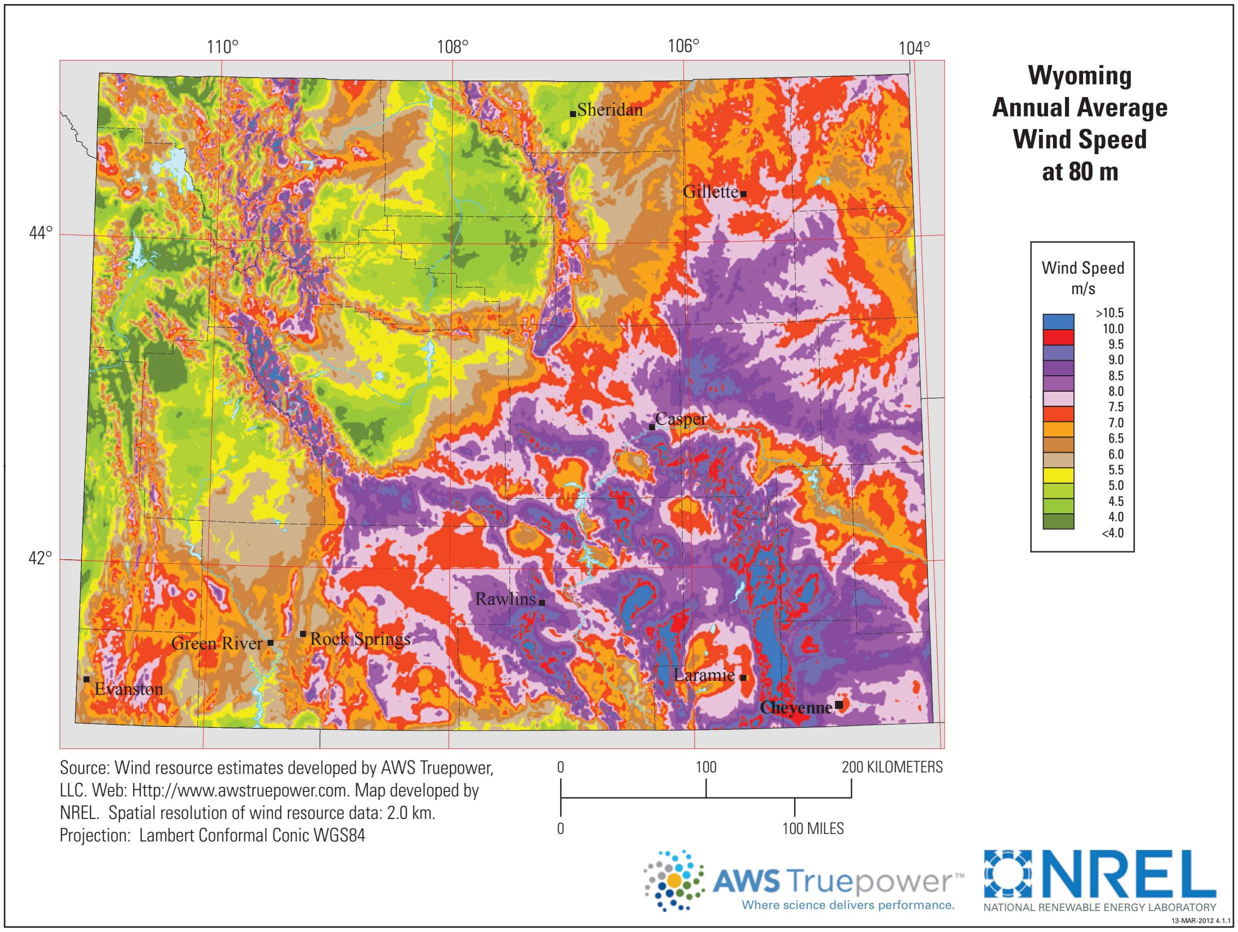

Figure 4. Wyoming wind potential map (written commun., U.S. Department of Energy and AWS Truepower, 2012). Areas with annual average wind speeds around 6.5 m/s and greater at an 80-m height are generally considered to have a resource suitable for wind development. Wind potential estimates for the state of Wyoming are available at the U.S. Department of Energy's Wind Powering America website at http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=wy.

Layer Information

Part A of the Energy Map of Southwestern Wyoming (pl. 1) displays many overlapping coal and wind features. Plate 1 was created directly from the ArcMap project (ESRI, 2000), which contains a number of additional layers not shown on the hardcopy map —that is, coal thickness and overburden categories, surface geology, surface and mineral ownership, and a variety of base cartographic GIS services. All of the layers included in the interactive map are described in table 1 with hyperlinks to source data information websites. Not described are geographic data, including county lines, lakes and rivers, and map annotations (largely from Jones and others, 2009). Further instructions for accessing the interactive map are included in the next section, 'Downloadable Data and the Interactive Map'.

Table 1. link

Downloadable Data and the Interactive Map

Part A of the Energy Map of Southwestern Wyoming is available as a GIS map project (both MXD and PMF formats) that can be downloaded at the USGS website. The GIS lets us visualize, question, analyze, and understand the coal and wind data in many ways that reveal relationships, patterns, and trends more effectively than with the static PDF map. The publishing process uses the ArcMap project (MXD) and creates a special file called a published map file (PMF). ArcGIS Publisher (ESRI, 2008a) is the extension used to create the PMF from the MXD; it packages the required data with the PMF file for easy distribution. PMFs can be viewed, explored, or printed using any ArcGIS (ESRI, 2000) desktop product, including ArcMap and the free ArcReader (ESRI, 2008b) application. Users can download and install the free

ArcReader software from ESRI. To access the MXD requires ArcGIS 9.3.1 or later software (ESRI, 2000).

As described in the Introduction section of this report, the Energy Map of Southwestern Wyoming, Part A, is a compilation of both published and previously unpublished energy resource data. For the previously published data, the accompanying metadata have been retained as published. The difference between the original published data and the version included here is that, other than the coalbed gas assessment units (AU), the features have been clipped to the WLCI boundary. Although they appear clipped to the WLCI boundary on the map, each of the AU areas in its entirety is included in the geodatabase.

All data are stored in a file-based geodatabase (WLCI_CoalWindMap.gdb) using the World Geodetic System (WGS) 1984 projection, which is a standard projection for distributing geospatial data. For the ArcGIS.com web services (formerly ArcGIS Online; ESRI, 2010), data descriptions, sources, and credits are stored as layer properties. Included in the geodatabase for each coal bed or zone in the 1999 assessment, are the data-point locations (drill hole or outcrop), and the spatial query layers that contain representations of numerous themes for multiple theme queries. Attributes of the spatial query layer include coal thickness category, overburden category, mine name, quadrangle name, surface ownership, and subsurface coal ownership.

Environmental Quality

The USGS has a long standing program assessing energy resources, including coal, gas, oil, uranium, and geothermal, as well as assessing environmental and health effects of the development and utilization of these resources. Investigation of geologic, technologic, environmental, and economic factors controlling the production and use of both conventional fuels (oil, gas and coal) and unconventional fuels such as gas hydrates, coalbed methane, oil shale, heavy oil and natural bitumen, and tar sands is carried out by the USGS Energy Resources Program. Schweinfurth (2009) described how the continued and increasingly large-scale use of coal in the United States and in many industrialized and developing nations has raised speculation about possible hazards to environmental quality and human health. There is still much to be learned about coal to make its use less harmful to humans and nature and more useful for the general welfare (Schweinfurth, 2009).

One type of renewable electricity is produced from wind, which may reduce greenhouse gas emissions produced from burning fossil fuels in power plants. The BLM reports that generating energy from wind is only one aspect of developing renewable energy resources on the public lands in Wyoming. The lack of power transmission infrastructure in the relatively remote and unpopulated areas of Wyoming with high wind potential would require the construction of new power transmission lines (U.S. BLM, 2010c). Wind turbines can interfere with viewsheds of pristine areas of natural beauty like some of Wyoming's historic trails, and the wind turbine air-warning systems cause light pollution and potential adverse impacts on rural communities and family ranches. Further studies on the technology and design of wind turbines and more careful placement, such as outside of migratory paths, are needed to address the problem of bat and bird fatalities. In areas like the city of Rawlins where both private and Federal oil and gas rights are present, the need for turbines, oil and gas wells, ranching and recreation must coexist (Heather Nino, U.S. BLM *in* Nuccio and others, 2010).

Data included in this report show that electrical generation in southwestern Wyoming is largely from coal, wind and hydroelectric. Table 2 shows that most of southwestern Wyoming's current electrical generation capacity is from coal-power generating facilities (approximately 3,024 MW).

Electrical generation is based on many factors, including, but not limited to load and demand. Wind energy can only generate power if the wind is blowing within a certain range. Wind turbines will shut off if wind speeds are too slow, too fast, or too gusty. Considering these aspects, we can only generalize potential electrical power sources.

Southwestern Wyoming wind energy nameplate capacity is currently about 674 MW, and hydro about 100 MW. Approximately 79 percent of electrical generation capacity is from coal, approximately 18 percent from wind and approximately 3 percent from hydro (fig. 5).

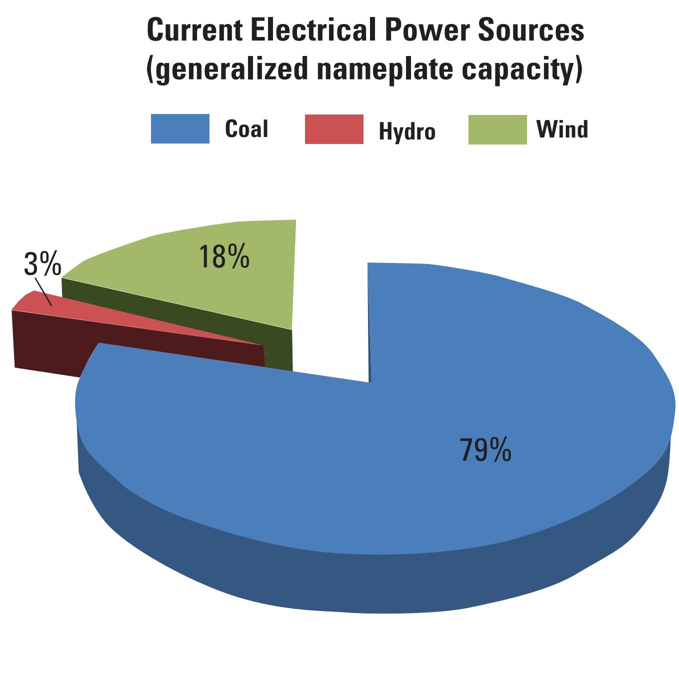

Figure 5. Generalized current electrical power nameplate capacity by source in southwestern Wyoming.

Table 2. Southwestern Wyoming electrical generation capacity, November 2010.

[MW, approximate values]

Status	Name	Capacity (MW)	CO_2	Number of units	Primary energy source	Secondary energy source	Data source
online	Jim Bridger Plant	2,317.7	827	4	Coal	diesel	Jones and others, 2009; Stafford, 2010
online	Naughton Power Plant	707.2	273	3	Coal	natural gas	
Totals		**3,024.9**	**1,100**	**7**	**Coal**		
online	Fontanelle Powerplant	10	0	1	hydro		Jones and others, 2009; Stafford, 2010
online	Kortes Powerplant	36	0	3	hydro		
online	Seminoe Powerplant	51.6	0	3	hydro		
online	Strawberry Creek Plant	1.5	0	3	hydro		
online	Swift Creek Powerplant	1.5		1	hydro		Stafford, 2010
Totals		**100.6**	**0**	**11**	**hydro**		
online	Foote Creek Rim wind project	84.8	0	133	wind		Jones and others, 2009; Stafford, 2010a, b
online	High Plains wind project	99	0	66	wind		PacifiCorp, 2010
online	McFadden wind project	28.5	0	19	wind		
online	Medicine Bow wind project	8.6	0	10	wind		Jones and others, 2009; Stafford, 2010a, b
online	Mountain Wind wind project	140.7	0	67	wind		
online	Rock River LLC wind project	50	0	50	wind		
online	Seven Mile Hill wind project	118.5	0	79	wind		
online	Wyoming Wind Energy Center	144	0	80	wind		
Totals		**674.1**	**0**	**504**	**wind**		
90% completion	Dunlap I wind project	111	0	74	wind		Jones and others, 2009; Stafford, 2010a, b
construction	Dunlap II wind project	189		126	wind		Stafford, 2010a, b
Totals		**300**	**0**	**200**	**wind construction**		
proposed	Chokecherry wind project	1,350	0	675	wind		Jones and others, 2009; Stafford, 2010b; U.S. BLM, 2010b, 2012
proposed	Sierra Madre wind project	650	0	325	wind		
proposed	White Mountain wind project	360	0	240	wind		
Totals		**2,360**	**0**	**1,240**	**wind proposed**		
postponed	Simpson Ridge wind project	300	0	199	wind		Jones and others, 2009; Stafford, 2010b
Totals		**300**	**0**	**199**	**wind postponed**		

Summary

Both coal and wind are among the energy resources being developed in southwestern Wyoming. Collecting baseline data to assess what is known about southwestern Wyoming's energy resources and ecosystems, and developing methods for archiving and disseminating this information to collaborators and the public (Nuccio and others, 2010), are the focus of the USGS and partners of the WLCI. Work to assemble a comprehensive inventory of pertinent data available to the public as an online resource is being done for the WLCI. An integrated assessment (IA) was initiated to synthesize what has been learned about WLCI systems to date, and to develop associated decision tools, maps, and a comprehensive report (Bowen and others, 2010). To further advance the objectives of the USGS and the WLCI, the Energy Map of Southwestern Wyoming, Part A, represents decades of research by the USGS, WSGS, and others, and will facilitate landscape-level science assessments, and informed resource management decision making. Energy maps, data, documentation and spatial data processing capabilities for this report can be found at *http://pubs.usgs.gov/ds/683*.

Acknowledgments

The Energy Map of Southwestern Wyoming was funded by the USGS Wyoming Landscape Conservation Initiative project. Part A of the Energy Map of Southwestern Wyoming is a compilation of both published and previously unpublished energy resources data. Because the coal map of Wyoming (Jones and others, 2009), was published as GIS layers, some of the data, symbology, and many of the annotations included on plate 1 were taken directly from that source. The manuscript was technically reviewed by David C. Scott and William R. Keefer of the USGS, and we thank them for their thoughtful evaluations and suggestions. Lisa Binder (USGS) is gratefully acknowledged for editorial review.

References

Addcar Highwall Mining System, 2010, Jim Bridger Mine: ©Addcar Systems LLC., Ashland, Ky. Accessed on Jan. 27, 2012 at *http://www.addcarsystems.com/customers/sc_jimbridgermine.html.*

Adobe Systems Incorporated, 2010, Adobe Reader 9: Adobe Systems Inc., San Jose, Calif. Accessed on Jan. 27, 2012 at *http://www.adobe.com/products/reader/?promoid=DJDXD.*

AECOM, Inc., 2009, Chokecherry and Sierra Madre Wind Energy Project environmental impact statement scoping summary report, document no. 12907–001–140, prepared for the Bureau of Land Management Rawlins Field Office by AECOM Inc., Los Angeles, Calif. Accessed on Jan. 27, 2012 at *http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rfodocs/chokecherry/report.Par.52243.File.dat/ScopingReport.pdf.*

Al Perry Enterprises Inc., 2005, Brochure: ©New Stansbury Coal Company LLC, Evansville, Ind. Accessed on Jan. 27, 2012 at *http://www.alperry.com/images/pdf/new%20stansbury%20brochure%202005.pdf.*

Al Perry Enterprises Inc., 2006, Project summary: ©New Stansbury Coal Company LLC, Evansville, Ind. Accessed on Jan. 27, 2012 at *http://www.alperry.com/newstansbury.html.*

American Society for Testing and Materials, 1994, Annual book of ASTM Standards, section 5, Petroleum products, lubricants and fossil fuels, v. 05.05 Gaseous fuels, coal and coke, section D388–92a, Standard Classification of Coal by Rank: American Society for Testing and Materials, Philadelphia, Penn., p. 168–171.

Arch Coal, Inc., 2007, Our commitment: ©Arch Coal, Inc., St. Louis, MO. Accessed on Jan. 27, 2012 at *http://www.archcoal.com/community/ACI-Responsibility-Report.pdf.*

Arch Coal, Inc., 2010, Our mines: ©Arch Coal Inc., Hanna Wyo. Accessed on Jan. 27, 2012 at *http://www.archcoal.com/aboutus/archofwyoming.aspx.*

Ball, M.W., 1909, The western part of the Little Snake River coal field, Wyoming, *in* Campbell, M.R., ed., Contributions to economic geology, 1907, Part II—Coal and lignite: U.S. Geological Survey Bulletin 341, p. 243–255, scale 1:250,000.

Ball, M.W., and Stebinger, Eugene, 1910, The eastern part of the Little Snake River coal field, Wyoming, *in* Campbell, M.R., ed., Contributions to economic geology, 1908, Part II—Mineral fuels: U.S. Geological Survey Bulletin 381, p. 186–213, scale 1:250,000.

Berryhill, H.L., Jr., Brown, D.M., Brown, A., and Taylor, D.A., 1950, Coal resources of Wyoming: U.S. Geological Survey Circular 81, 78 p.

Biewick, Laura R.H., 2009, Oil and Gas Development in Southwestern Wyoming—Energy Data and Services for the Wyoming Landscape Conservation Initiative (WLCI): U.S. Geological Survey Digital Data Series DS 437. Available at *http://pubs.usgs.gov/ds/437/.*

Biewick, Laura R.H., 2011, Geodatabase of Wyoming statewide oil and gas drilling activity to 2010: U.S. Geological Survey Data Series 625. Available at *http://pubs.usgs.gov/ds/625/.*

Bleizeffer, Dustin, 2010, Against the wind? Wyoming tax policy, other factors drive slowdown in wind farm construction, industry says, *in* trib.com, posted Monday, Oct. 18, 2010: ©Casper Star Tribune, Casper, Wyo. Accessed on Jan. 27, 2012 at *http://trib.com/news/state-and-regional/article_60befa58-1aea-5fb6-a931-b0213d6540a4.html.*

Boreck, D.L., and Weaver, J.N., 1984, Coalbed methane study of the Anderson coal deposit, Johnson County, Wyoming—A preliminary report: U.S. Geological Survey Open–File Report 84–831, 16 p.

Bowen, Z.H., Aldridge, C.L., Anderson, P.J., Assal, T.J., Biewick, L.R.H., Blecker, S.W., Bristol, S., Carr, N.B., Chalfoun, A.D., Chong, G.W., Diffendorfer, J.E., Fedy, B.C., Garman, S.L., Germaine, S., Grauch, R.I., Holloway, J., Homer, C., Kauffman, M.J., Keinath, D., Latysh, N., Manier, D., McDougal, R.R., Melcher, C.P., Miller, K.A., Montag, J., Nutt, C.J., Potter, C.J., Sawyer, H., Schell, S., Shafer, S.L., Smith, D.B., Stillings, L.L., Tuttle, M., and Wilson, A.B., 2010, U.S. Geological Survey science for the Wyoming Landscape Conservation Initiative—2009 Annual Report: U.S. Geological Survey Open–File Report 2010–1231, 106 p. Available at *http://pubs.usgs.gov/of/2010/1231/.*

Cavaroc, V.V., Flores, R.M., Nichols, D.J., and Perry, W.J., 1992, Paleocene tectono-facies relationships between the Hanna, Carbon, and Cooper Lake basins, Wyoming: American Association of Petroleum Geologists Bulletin, v. 76, p. 1257.

Chevron Corp., 2009, 2009 Supplement to the Annual Report: ©Chevron Corp., San Ramone, Calif. Accessed on Jan. 27, 2012 at *http://www.chevron.com/documents/pdf/chevron2009annualreportsupplement.pdf.*

Chevron Corp., 2011, Mining: ©Chevron Corp., San Ramone, Calif. Accessed on Jan. 27, 2012 at *http://www.chevron.com/about/ourbusiness/otherbusinesses/mining/.*

Clipper Windpower, 2008, Projects—Medicine Bow-Liberty prototype: ©Clipper Windpower LLC., Carpinteria, Calif. Accessed on Jan. 27, 2012 at *http://www.clipperwind.com/medicinebow.html.*

Dames and Moore Company, 1978a, Coal resource occurrence and coal development potential maps of the southwest quarter of the Rawlins Peak 15-minute quadrangle, Carbon County, Wyoming: U.S. Geological Survey Open–File Report 78–618, 28 p., 18 pls., scale 1:24,000.

Dames and Moore Company, 1978b, Coal resource occurrence and coal development potential maps of the northwest quarter of the Bridger Pass 15-minute quadrangle, Carbon County, Wyoming: U.S. Geological Survey Open-File Report 78–619, 32 p., 32 pls., scale 1:24,000.

Dames and Moore Company, 1978c, Coal resource occurrence and coal development potential maps of the Fillmore Ranch quadrangle, Carbon County, Wyoming: U.S. Geological Survey Open-File Report 78–621, 31 p., 38 pls., scale 1:24,000.

Dames and Moore Company, 1979a, Coal resource occurrence and coal development potential maps of the Riner quadrangle, Carbon and Sweetwater Counties, Wyoming: U.S. Geological Survey Open-File Report 79–116, 32 p., 32 pls., scale 1:24,000.

Dames and Moore Company, 1979b, Coal resource occurrence and coal development potential maps of the Seaverson Reservoir quadrangle, Carbon County, Wyoming: U.S. Geological Survey Open-File Report 79–118, 27 p., 31 pls., scale 1:24,000.

Dames and Moore Company, 1979c, Coal resource occurrence and coal development potential maps of the northwest quarter of the Doty Mountain 15-minute quadrangle, Carbon County, Wyoming: U.S. Geological Survey Open-File Report 79–1382, 38 p., 32 pls., scale 1:24,000.

DeBruin, R.H., Lyman, R.M., Jones, R.W., Cook, L.W., 2004, Coalbed methane in Wyoming, Wyoming State Geological Survey Information Pamphlet 7 (second version): Wyoming State Geological Survey, Laramie, Wyo. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/docs/coalbed.pdf.*

Dickinson, W.R., Klute, M.A., Hayes, M.J., Janecke, S.U., Lundin, E.R., McKittrick, M.A., and Olivares, M.D., 1988, Paleographic and paleotectonic setting of Laramide sedimentary basins in the central Rocky Mountain region: Geological Society of America Bulletin, v. 100, p. 1023–1039.

Dobbin, C.E., Bowen, C.F., and Hoots, H.W., 1929, Geology and coal and oil resources of the Hanna and Carbon basins, Carbon County, Wyoming: U.S. Geological Survey Bulletin 804, 88 p.

Dobson, G.B., 2010, Wyoming Tales and Trails: G.B. Dobson, St. Augustine, Fla., cuna66@aol.com. Accessed on Jan. 27, 2012 at *http://www.wyomingtalesandtrails.com/.*

Dyman, T.S., and Condon, S.M., 2007, 2005 Geologic assessment of undiscovered oil and gas resources, Hanna, Laramie, and Shirley Basins Province, Wyoming and Colorado, chap. 2, *in* U.S. Geological Survey, Hanna, Laramie, and Shirley Basins Province Assessment Team, eds., Petroleum Systems and Geologic Assessment of Undiscovered Oil and Gas, Hanna, Laramie, and Shirley Basins Province, Wyoming: U.S. Geological Survey Digital Data Series DDS–69–K, 68 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-k/REPORTS/69_K_CH_2.pdf.*

Dyman, T.S., Condon, S.M., Ahlbrandt, T.S., Charpentier, R.R.., Cook, T.A., Klett, T.R., Lewan, M.D., Lillis, P.G., Pawlewicz, M.J., Pollastro, R.M., and Schenk, C.J., 2006, 2005 Assessment of undiscovered oil and gas resources in Hanna, Laramie, and Shirley Basins Province, Wyoming: U.S. Geological Survey Fact Sheet 2005–3125, 4 p. Available at *http://pubs.usgs.gov/fs/2005/3125/.*

Elliot, D.L., Holladay, C.G., Barchet, W.R., Foote H.P., Sandusky, W.F., 1986, Wind energy resource atlas of the United States, prepared for the U.S. Department of Energy: Published by the Solar Technical Information Program, Solar Energy Research Institute [now the National Renewable Energy Laboratory], Golden, Colo. Accessed on Jan. 27, 2011 at *http://rredc.nrel.gov/wind/pubs/atlas/titlepg.html.*

Ellis, M.S., 1987, Coal resources, *in* Roehler, H.W., and Martin, P.L., eds., Geological investigations of the Vermillion Creek coal bed in the Eocene Niland Tongue of the Wasatch Formation, Sweetwater County, Wyoming: U.S. Geological Survey Professional Paper 1314A–L, p. 191–202.

Ellis, M.S., Gunther, G.L., Flores, R.M., Ochs, A.M., Stricker, G.D., Roberts, S.B., Taber, T.T., Bader, L.R., Blake, D., and Schuenemeyer, J.H., 1999a, Coal resources, Greater Green River Basin, chap. GN, *in* U.S. Geological Survey Fort Union Assessment Team, ed., 1999 Resource assessment of selected tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. GN1–GN25. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/GN.pdf.*

Ellis, M.S., Gunther, G.L., Flores, R.M., Ochs, A.M., Stricker, G.D., Roberts, S.B., Taber, T.T., Bader, L.R., Blake, D., and Schuenemeyer, J.H.,, 1999b, Coal resources of the Hanna and Carbon basins, chap. HN, *in* U.S. Geological Survey Fort Union Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. HN1–HN99. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/HN.pdf.*

Encyclopedia Brittanica, 2010, bituminous coal: Encyclopædia Brittanica Inc., Chicago, Ill. Accessed on Jan. 27, 2012 at *http://www.britannica.com/EBchecked/topic/67274/bituminous-coal.*

Encyclopedia Brittanica, 2010, subbituminous coal: Encyclopædia Brittanica, Inc. Chicago, Ill. Accessed on Jan. 27, 2012 at *http://www.britannica.com/EBchecked/topic/570576/subbituminous-coal.*

Environmental Systems Research Institute, Inc. (ESRI), 2000, ArcGIS: ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.esri.com/software/arcgis/index.html.*

Environmental Systems Research Institute, Inc. (ESRI), 2008a, ArcPublisher: ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.esri.com/software/arcgis/extensions/publisher/index.html* and *http://www.esri.com/software/arcgis/extensions/publisher/publishing.html.*

Environmental Systems Research Institute, Inc. (ESRI), 2008b, ArcReader: ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.esri.com/software/arcgis/arcreader/download.html.*

Environmental Systems Research Institute, Inc. (ESRI), 2009, World Reference Overlay: ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.arcgis.com/home/item.html?id=9763d83ba63048da8a2e0a71ccea4416.*

Environmental Systems Research Institute, Inc. (ESRI), 2010, ArcGIS online: ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.esri.com/software/arcgis/arcgisonline/index.html.*

Environmental Systems Research Institute, Inc. (ESRI), 2010, ESRI_StreetMap_World_2D, ArcGIS Online Services – Ready-to-Use Content on Demand: ESRI, Redlands, Calif. Available at *http://www.esri.com/software/arcgis/arcgisonline/index.html*.

Environmental Systems Research Institute, Inc. (ESRI), 2012, Geodatabase, ©ESRI, Redlands, Calif. Accessed on Jan. 27, 2012 at *http://www.esri.com/software/arcgis/geodatabase/index.html.*

Evans, J.A., 1865, Report of Jas. A. Evans of exploration from Camp Walbach to Green River: Union Pacific Railroad Historical Museum, location file K–13–1, 11 p.

Finn, T.M., and Johnson, R.C., 2005, Subsurface stratigraphic cross sections of Cretaceous and Lower Tertiary rocks in the Southwestern Wyoming Province, Wyoming, Colorado and Utah, chap. 14, *in* U.S. Geological Survey Southwestern Wyoming Province Assessment Team, ed., Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, ver. 1.0, 9 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/REPORTS/69_D_CH_14.pdf.*

Finn, T.M., Johnson, R.C., and Roberts, S.B., 2005, The Mesaverde–Lance–Fort Union Composite Total Petroleum System, Southwestern Wyoming Province, chap. 10, *in* U.S. Geological Survey Southwestern Wyoming Province Assessment Team, ed., Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, Version 1.0, 37 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/REPORTS/69_D_CH_10.pdf.*

Flores, R.M., and Bader, L.R., 1999, Fort Union coal in the Greater Green River Basin, east flank of the Rock Springs uplift, Wyoming—A Synthesis, chap. GS, *in* U.S. Geological Survey Fort Union Coal Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. GS1–GS36. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/GS.pdf.*

Flores, R.M., and Nichols, D.J., 1999, Introduction, chap. IN, *in* U.S. Geological Survey Fort Union Coal Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the Northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. IN1–IN58. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/IN.pdf.*

Flores, R.M., Cavaroc, V.V., Jr., and Bader, L.R., 1999a, Ferris and Hanna coal in the Hanna and Carbon basins, Wyoming—A synthesis, chap. HS, *in* U.S. Geological Survey Fort Union Coal Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. HS1–HS45. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/HS.pdf.*

Flores, R.M., Cavaroc, V.V., Jr., and Bader, L.R., 1999b, Framework geology of Ferris and Hanna coal in the Hanna and Carbon basins, chap. HF, *in* U.S. Geological Survey Fort Union Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2., p. HF1–HF49. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/HF.pdf.*

Flores, R.M., Ochs, A.M., and Bader, L.R., 1999c, Framework geology of Fort Union coal in the eastern Rock Springs uplift, Greater Green River basin, Wyoming, chap. GF, *in* U.S. Geological Survey Fort Union Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, ver. 1.2, p. GF1–GF41. Available at *http://pubs.usgs.gov/pp/p1625a/Chapters/GF.pdf.*

Gardner, A.D., and Flores, V.R., 1989, Forgotten frontier—A history of Wyoming coal mining: Westview Press, Boulder, Colo., 243 p.

Gearino, Jeff, 2010a, Expansion planned at Bridger power plant, *in* trib.com, posted Dec. 4, 2006: ©Casper Star Tribune, Casper, Wyo. Accessed on Jan. 27, 2012 at *http://trib.com/news/state-and-regional/article_716aacf1-6fd6-50cf-b3f7-f30e4166dd7b.html.*

Gearino, Jeff, 2010b, Company plans total increase of approximately 2,000 acres—Bridger Coal mine in southwest Wyoming expands, *in* trib.com, posted Aug. 2, 2010: ©Casper Star Tribune, Casper, Wyo. Accessed on Jan. 27, 2012 at *http://trib.com/news/state-and-regional/article_9d448806-0023-5f28-a330-e838b10746a0.html.*

Glass, G.B., 1976, Review of Wyoming coal fields, 1976: Wyoming State Geological Survey, Wyoming Public Information Circ. no. 4, 21 p.

Glass, G.B, 1977, Wyoming coal and coal mining, *in* Contributions to Geology: University of Wyoming, v. 15, no. 2, 1977. Accessed on Jan. 27, 2012 at *http://rmg.geoscienceworld.org/content/15/2/79.full.pdf.*

Glass, G.B., 1981, Coal deposits of Wyoming, *in* Reid, S.G., and Miller, D.D., eds., Energy resources of Wyoming, 32nd Annual Field Conference Guidebook,: Wyoming Geological Association, Sept. 20-22, 1981, p. 181–236.

Glass, G.B., and Jones, R.W., 1991, Coal Fields and Coal Beds of Wyoming *in* Wyoming Geological Association Guidebook, 42nd Annual Field Conference Guidebook: Wyoming Geological Association, p. 133–167. Accessed on Jan. 27, 2012 at *http://search.datapages.com/data/wga/data/051/051001/pdfs/133.pdf.*

Glass, G.B., and Roberts, J.T., 1979, Remaining strippable coal resources and strippable reserve base of the Hanna coal field in south-central Wyoming: Geological Survey of Wyoming Report of Investigations no. 17, 166 p.

Glass, G.B., and Roberts, J.T., 1980, Coal and coal-bearing rocks of the Hanna coal field, Wyoming: Geological Survey of Wyoming Report of Investigations no. 22, 41 p.

Glass, G.B., and Roberts, J.T., 1984, Analysis and measured sections of 25 coal samples from Hanna coal field of south-central Wyoming: Geological Survey of Wyoming Report of Investigations 27, 104 p.

Green, G. N., and Drouillard, P. H., 1994, The digital geologic map of Wyoming in ARC/INFO format: U.S. Geological Survey Open-File Report 94–425.

Hatch, J.R., 1987, Element geochemistry, *in* Roehler, H.W., and Martin, P.L., eds., Geological investigations of the Vermillion Creek coal bed in the Eocene Niland Tongue of the Wasatch Formation, Sweetwater County, Wyoming: U.S. Geological Survey Professional Paper 1314A–L, p. 121–131.

Hettinger, R.D., and Kirschbaum, M.A., 1991, Chart showing correlations of some Upper Cretaceous and lower Tertiary rocks, from the east flank of the Washakie Basin to the east flank of the Rock Springs uplift, Wyoming: U.S. Geological Survey Miscellaneous Investigations Series Map I–2152.

Hettinger, R.D., Honey, J.G., Ellis, M.S., Barclay, C.S.V., and East, J.A., 2008, Geologic map of Upper Cretaceous and Tertiary strata and coal stratigraphy of the Paleocene Fort Union Formation, Rawlins–Little Snake River area, south-central Wyoming: U.S. Geological Survey Scientific Investigations Map 3053, 3 sheets. Available at *http://pubs.usgs.gov/sim/3053/.*

Hutchinson, W., 2001, Before the Environmental Quality Council State of Wyoming, In The Matter of Rag Shoshone (f/k/a) Cyprus Shoshone Coal Corporation, Mining Permit No. 477-T4 DEQ Docket No. 3073-99, DOCKET NO. 99-4601: Environmental Quality Council State of Wyoming, Cheyenne, Wyo. Accessed on Jan. 27, 2012 at *http://deq.state.wy.us/eqc/orders/Land%20Closed%20Cases/3073-99%20RAG.pdf.*

Iberdrola Renewables, 2010, Southwest Wyoming: ©Iberdrola Renewables, Portland Ore. Accessed on Jan. 27, 2012 at *http://www.iberdrolarenewables.us/cs_wy.html.*

Johnson, R.C., Finn, T.M., and Roberts, L.N.R., 2005, The Mesaverde Total Petroleum System, Southwestern Wyoming Province, chap. 8, *in* USGS Southwestern Wyoming Province Assessment Team, ed., Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, ver. 1.0, 43 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/REPORTS/69_D_CH_8.pdf.*

Jones, N.R., 2009, A paradigm in the genesis of thick coal deposits and their unique angular relationships—A result of differential development of accommodation in the Powder River Basin, Wyoming: Laramie, Wyo., University of Wyoming, M.S. thesis, 75 p.

Jones, N.R., Jones, R.W., Scott, J.E., and Lucke, D.W., 2009, Coal map of Wyoming: Wyoming State Geological Survey Map Series 93. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/AboutWSGS/coal.aspx.*

Keith, R.E., 1965, Rock Springs and Blair Formations on and adjacent to the Rock Springs uplift, Wyoming Geological Association Guidebook, 19th Annual Field Conference: Wyoming Geological Association, p. 43–53.

Keystone Coal Industry Manual, 1999, Coal geology of Wyoming: Chicago, Primedia Intertec, p. 714–734.

Kiewit Corp., 2010, Mining Projects, Hanna, WY: ©Kiewit Corp., Omaha, Neb. Accessed on Jan. 27, 2012 at *http://www.kiewit.com/projects/mining.aspx?pg=1.*

Kirschbaum, M.A., Charpentier, R.R., Crovelli, R.A., Klett, T.R., Pollastro, R.M., and Schenk, C.J., 2004, Assessment of undiscovered oil and gas resources of the Wyoming Thrust Belt Province, 2003: U.S. Geological Survey Fact Sheet 2004–3025, 2 p. Available at *http://pubs.usgs.gov/fs/2004/3025.*

Kirschbaum, M.A., Finn, T.M., Hettinger, R.D., Johnson, E.A., Johnson, R.C., Kibler, J., Lillis, P.G., Nelson, P.H., Roberts, L.N.R., Roberts, S.B., Charpentier, R.R., Cook, T.A., Crovelli, R.A., Klett, T.R., Pollastro, R.M., and Schenk, C.J., 2002, Assessment of undiscovered oil and gas resources of the Southwestern Wyoming Province, 2002: U.S. Geological Survey Fact Sheet 145–02, 2 p. Available at *http://pubs.usgs.gov/fs/fs-145-02/.*

Knight, C.N., Hurley, N.F., and Clower, G.D., 2000, Reservoir characterization using logs, core, and borehole images, Mesaverde Sandstone—North LaBarge Field, Sublette County, Wyoming, *in* Classical Wyoming Geology in the New Millennium, 51st Field Conference Guidebook, 2000: Wyoming Geological Association, p. 75–120. Accessed on Jan. 27, 2012 at *http://search.datapages.com/data/wga/data/064/064001/pdfs/75.pdf.*

Land, C.B., Jr., 1972, Stratigraphy of Fox Hills Sandstone and associated formations, Rock Springs uplift and Wamsutter arch area, Sweetwater County, Wyoming—A shoreline-estuary sandstone model for the Late Cretaceous: Colorado School of Mines Quarterly, v. 67, 69 p.

Law, B.E., 1996, Southwestern Wyoming Province (037), *in* Gautier, D.L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., eds., 1995 National assessment of United States oil and gas resources—Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS–30, release 2. Accessed on Jan. 27, 2012 at *http://certmapper.cr.usgs.gov/data/noga95/prov37/text/prov37.pdf.*

Lasik Computer Services, 2010, City of Kemmerer home page: ©Lasic Computer Services, Kemmerer, Wyo. Accessed on Jan. 27, 2012 at *http://www.kemmerer.org./*

Lawrence, D.T., 1992, Primary controls on total reserves, thickness, geometry, and distribution of coal seams–Upper Cretaceous Adaville Formation, southwestern Wyoming, *in* McCabe, P.J., and Parrish, J.T., eds., 1992, Controls on the distribution and quality of Cretaceous coals: Geological Society of America Special Paper 267.

Levey, R.A., 1985, Depositional model for understanding geometry of Cretaceous coals–Major coal seams, Rock Springs Formation, Green River Basin, Wyoming: American Association of Petroleum Geologists Bulletin, v. 69, p. 1359-1380.

Lillegraven, J.A., and Ostresh, L.M., Jr., 1988, Evolution of Wyoming's early Cenozoic topography and drainage patterns: National Geographic Research, v. 4, p. 303–327.

Love, J.D., and Christiansen, A.C., 1985, Geologic map of Wyoming: U.S. Geological Survey, scale 1:500,000.

Magoon, L.B., and Schmoker, J.W., 2000, The Total Petroleum System—The natural fluid network that constrains the assessment unit, chap. PS, *in* U.S. Geological Survey World Petroleum Assessment 2000—Description and results by U.S. Geological Survey World Energy Assessment Team: U.S. Geological Survey Digital Data Series DDS–60, ver. 1.1, p. PS-1–PS-20 Available at *http://energy.cr.usgs.gov/WEcont/chaps/PS.pdf* and *http://pubs.usgs.gov/dds/dds-060/.*

Marketwatch, 2011, Chevron leaving U.S. coal industry: ©The Wall Street Journal, New York, N.Y., posted Jan. 29, 2011. Accessed on Jan. 27, 2012 at *http://www.marketwatch.com/story/chevron-leaving-us-coal-industry-2011-01-29.*

Masursky, Harold, 1962, Uranium-bearing coal in the eastern part of the Red Desert area, Wyoming: U.S. Geological Survey Bulletin 1099–B, 152 p.

Maywood, P.S., 1987, Stratigraphic model of the southern portion of the Jim Bridger coal field, Sweetwater County, Wyoming: Portland, Ore., Portland State University, M.S. thesis, 128 p.

McLaughlin, J.F., Frost, C.D., and Sharma, Shikha, 2010, Isotopic analysis of aquifer systems, Atlantic Rim, Carbon County, Wyoming–A new tool for characterizing coalbed natural gas systems, 2009 Portland GSA meeting Oct. 18–21, 2009: Geological Society of America, paper no. 215–7. Accessed on Jan. 27, 2012 at *http://gsa.confex.com/gsa/2009AM/finalprogram/abstract_161157.htm.*

McLaughlin, J.F., Frost, C.D., and Sharma, Shikha., 2009, Sr and C Isotopic analysis of waters produced from coalbeds, Atlantic Rim, Wyoming—Predictive tools for optimizing coalbed natural gas production *in* American Association of Petroleum Geologists annual convention and exhibition, Denver, Colo. June 7–10, 2009: American Association of Petroleum Geologists. Accessed on Jan. 27, 2012 at *http://www.searchanddiscovery.net/abstracts/html/2009/annual/abstracts/mclauglin.htm?q=%2Btext%3A%22atlantic+rim%22.*

Merewether, E.A., 1971, Geologic map of the Wild Horse Mountain quadrangle, Carbon County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ–887, scale 1:24,000.

Merewether, E.A., 1972, Geologic map of the Seminoe Dam SW quadrangle, Carbon County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ–1017, scale 1:24,000.

Merewether, E.A., 1973, Geologic map of the Lone Haystack Mountain quadrangle, Carbon County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ–1064, scale 1:24,000.

Microsoft, Corp., 2007, Getting started with Office 2007: Redmond, Wash., ©Microsoft Corp. Accessed on Jan. 27, 2012 at *http://office.microsoft.com/en-us/support/getting-started-with-microsoft-office-2007-FX101839657.aspx?CTT=97.*

NextEra Energy Resources, 2010, Wyoming Wind Energy Center: Juno Beach, Fla., ©NextEra Energy Resources, LLC. Accessed on Jan. 27, 2012 at *http://www.nexteraenergyresources.com/pdf_redesign/wyoming.pdf.*

Nielsen, John, Innis, Susan, Pollock, L.K., Rhoads-Weaver, Heather, and Shutak, Angela, 2002, Renewable energy atlas of the west— A guide to the region's resource potential, A project of the Hewlett Foundation and the Energy Foundation: Land and Water fund of the Rockies: Accessed on Jan. 27, 2012 at *http://www.energyatlas.org/PDFs/atlas_final.pdf.*

Nuccio, V.F., and D'Erchia, Frank, eds.; Parady, Katelyn, and Mellinger, Abby., comps., 2010, Wyoming Landscape Conservation Initiative Science and Management Workshop proceedings, May 12–14, 2009, Laramie, Wyo.: U.S. Geological Survey Scientific Investigations Report 2010–5067, 111 p. Available at *http://pubs.usgs.gov/sir/2010/5067/.*

Oder, R.R., 2003, Dry magnetic separation of ash, sulfur, and mercury from a southwestern Wyoming coal, presented at the 18th International Low Rank Fuels Symposium, June 24–26, 2003, Billings, Mont.: EERC, Grand Forks, N. Dak., University of North Dakota. Accessed on Jan. 27, 2012 at *http://magneticseparation.com/UserFiles/File/Paper_Low_Rank_Fuels.pdf.*

O'Donnell, M.S., and Fancher, T.S., 2010, Spatial mapping and attribution of Wyoming wind turbines: U.S. Geological Survey Data Series 524. Available at *http://pubs.usgs.gov/ds/524*.

PacifiCorp, 2010, Energy Sources, Renewable Energy: Portland, Ore., ©PacifiCorp, MidAmerica Energy Holdings Co. Accessed on Jan. 27, 2012 at *http://www.pacificorp.com/es/re.html*.

PacifiCorp, 2011, High Plains Wind Project: Portland, Ore., ©PacifiCorp, MidAmerica Energy Holdings Co. Accessed on Jan. 27, 2012 at *http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/EnergyGeneration_FactSheets/RMP_GFS_High_Plains.pdf.*

Parady, F.E., III, 1985, Reclamation techniques in southwestern Wyoming, *in* Environmental geochemistry and health, v. 7, no. 1: Springer Netherlands, p. 26-27. Accessed on Jan. 27, 2012 at *http://www.springerlink.com/content/q63v88443v726712/.*

Perry, W.J., Jr., and Flores, R.M., 1994, Sequential Laramide deformation and deep gas-prone basins of the Rocky Mountain region, *in* Dyman, T.S., Rice, D.D., and Wescott, W.A., eds., Geologic controls of deep natural gas resources in the U.S.: U.S. Geological Survey Bulletin 2146–E, p. 49–59.

Pipiringos, G.N., 1961, Uranium-bearing coal in the central part of the Great Divide Basin: U.S. Geological Survey Bulletin 1099–A, 104 p.

Platte River Power Authority, 2011, Medicine Bow on-line tour: Fort Collins, Colo.: ©Platte River Power Authority. Accessed on Jan. 27, 2012 at *http://www.prpa.org/sources/wind/medicinebowonlinetour.htm.*

Power Company of Wyoming LLC, 2010, Putting wind to work for Carbon County: ©Power Company of Wyoming. Accessed on April 21, 2010 at *http://www.powercompanyofwyoming.com/.*

Power Company of Wyoming LLC, 2012, Putting wind to work for Carbon County: ©Power Company of Wyoming. Accessed on Jan. 27, 2012 at *http://www.powercompanyofwyoming.com/.*

Quillinan, S.A., Worman, B.N., and Rodgers, J.R., 2009, Coalbed natural gas activity in the Atlantic Rim area, Carbon County, Wyoming: Wyoming State Geological Survey Open-File Report 09–7. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/News/Jan25_2010.aspx.*

Renewable Energy World.com, 2009, Build Out on McFadden Ridge Wind Starts: Peterborough, N.H., ©Renewable Energy World.com. Accessed on Jan. 27, 2012 at *http://www.renewableenergyworld.com/rea/news/article/2009/08/construction-underway-on-mcfadden-ridge-wind-project*.

Resource Data International, Inc., 1998, COALdat-Coal database: Boulder, Colo., Resource Data International, Inc.

Roberts, L.N.R., and Kirschbaum, M.A., 1995, Paleogeography of the Late Cretaceous of the Western Interior of middle North America—Coal distribution and sediment accumulation: U.S. Geological Survey Professional Paper 1561, 115 p. Available at *http://pubs.usgs.gov/pp/1561/report.pdf.*

Roberts, L., Kirschbaum, M., and McCabe, P., 1995, Paleogeography of the Late Cretaceous of the western interior of middle North America: U.S. Geological Survey poster. Available at *http://energy.cr.usgs.gov/coal_poster/cretcoals/cret.coals.html.*

Roberts, S.B., 2005a, Geologic assessment of undiscovered petroleum resources in the Lance–Fort Union Composite Total Petroleum System, Southwestern Wyoming Province, Wyoming and Colorado, chap. 11, *in* U.S. Geological Survey, Southwestern Wyoming Province Assessment Team, compilers, Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, Version 1.0, 45 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/REPORTS/69_D_CH_11.pdf.*

Roberts, S.B., 2005b, Geologic Assessment of Undiscovered Petroleum Resources in the Wasatch–Green River Composite Total Petroleum System, Southwestern Wyoming Province, Wyoming, Colorado, and Utah, chap. 12, *in* USGS Southwestern Wyoming Province Assessment Team, ed., Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, v. 1.0, 26 p. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/REPORTS/69_D_CH_12.pdf.*

Rocky Mountain Power, 2010, Dunlap I Wind Project Generating Renewable Energy for Customers: Portland, Ore., ©PacifiCorp, MidAmerica Energy Holdings Co. Accessed on Jan. 27, 2012 at *http://www.rockymountainpower.net/about/nr/nr2010/dwpgrec.html.*

Roehler, H.W., 1965, Summary of pre-Laramide late Cretaceous sedimentation in the Rock Springs uplift area, *in* Wyoming Geological Association Guidebook, 19th Annual Field Conference, p. 11–12: Casper, Wyo., Wyoming Geological Association.

Sanders, R.B., 1974, Geologic map and coal resources of the Riner quadrangle, Carbon and Sweetwater Counties, Wyoming: U.S. Geological Survey Coal Investigations Map C–68, scale 1:24,000.

Sanders, R.B., 1975, Geologic map and coal resources of the Creston Junction quadrangle, Carbon and Sweetwater Counties, Wyoming: U.S. Geological Survey Coal Investigations Map C–73, scale 1:24:000.

Schweinfurth, S.P., 2009, An introduction to coal quality, chap. C, *in* Pierce, B. S., and Dennen, K.O., eds., The national coal resource assessment overview: U.S. Geological Survey Professional Paper 1625–F, 20 p. Available at *http://pubs.usgs.gov/pp/1625f/downloads/ChapterC.pdf.*

Shell, 2010, Rock River: Houston, Tex., ©Shell Energy North America. Accessed on Jan. 27, 2012 at *http://www.shell.us/home/content/usa/innovation/wind/projects/wind_rockriver.html.*

Smith, J.B., Ayler, M.F., Knox, C.C., and Pollard, B.C., 1972, Strippable coal reserves of Wyoming—Location, tonnage, and characteristics of coal and overburden: U.S. Bureau of Mines Information Circular, no. 8538, 51 p.

Stafford, J.E., 2010a, Power Generation, a GIS shapefile: Wyoming Geological State Survey, WSGS Geographic Information Systems. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/GIS_and_online_maps/digital_data.aspx.*

Stafford, J.E., 2010b, Wind Farms, a GIS shapefile: Wyoming State Geological Survey, WSGS Geographic Information Systems. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/GIS_and_online_maps/digital_data.aspx.*

Stricker, G.D., Flores, R.M., Ochs, A.M., and Stanton, R.W., 2000, Powder River Basin coalbed methane—The USGS role in investigating this ultimate clean coal by-production, Proceedings of the 25th International Technical Conference on Coal Utilization and Fuel Systems. Coal Technology Association. Clearwater, Fla., 2000, p. 695–708.

Stricker, G.D., and Ellis, M.S., 1999, Coal quality and geochemistry, Greater Green River Basin, Wyoming, chap. GQ, *in* Fort Union Coal Assessment Team, ed., 1999 Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, p. GQ1–GQ49. Available at *http://greenwood.cr.usgs.gov/energy/coal/PP1625A/Chapters/GQ.pdf.*

Stricker, G.D., Ellis, M.E., Flores, R.M., and Bader, L.R., 1998, Elements of environmental concern in the 1990 Clean Air Act Amendments—A prospective of Fort Union coals in the northern Rocky Mountains and Great Plains region, *in* Sakkestad, B.A., ed., The Proceedings of the 23rd International Technical Conference on Coal Utilization and Fuel Systems: Coal & Slurry Technology Association, Clearwater, Fla., p. 967-976.

The Wind Power, 2010, Mountain Wind I windfarm, USA: Buc, France, ©The Wind Power. Accessed on Jan. 27, 2012 at *http://www.thewindpower.net/wind-farm-3232-mountain-wind-i-suzlon-nd.php.*

Town of Medicine Bow, Wyo., 2010, ©Town of Medicine Bow Wind Project, Medicine Bow, Wyo. Accessed on Jan. 27, 2012 at *http://medicinebow.org/index.php?option=com_content&view=article&id=141:wind-project&catid=46:econimic-developemnt&Itemid=59.*

Trumbull, J.B.A., 1960, Coal fields of the United States, exclusive of Alaska, sheet 1: U.S. Geological Survey, scale 1:1,500,000.

Tully, John, compiler, 1996, Coal fields of the Conterminous United States: U.S. Geological Survey Open-File Report 96–92. Available at *http://pubs.usgs.gov/of/1996/of96-092/.*

Tyler, R., and McMurry, R.G., 1993, Stratigraphy and coal occurrence of the Paleocene Fort Union Formation, Sand Wash Basin, *in* Kaiser, W.R., Scott, A.R., Hamilton, D.S., Tyler, Roger, McMurry, R.G., Zhou, Naijiang, and Tremain, C.M., [contributors], Geologic and hydrologic controls on coalbed methane—Sand Wash Basin, Colorado and Wyoming: Gas Research Institute, Topical Report GR–92/0420, p. 79–106.

Tyler, R., Kaiser, W.R., Scott, A.R., Hamilton, D.S., and Ambrose, W.A., 1995, Geologic and hydrologic assessment of natural gas from coal—Greater Green River, Piceance, Powder River, and Raton Basins, Western United States: Bureau of Economic Geology and the Gas Research Institute Report of Investigations no. 228, 219 p.

Union Pacific, 2010a, Black Butte Mine: Omaha, Neb., ©Union Pacific. Accessed on Jan. 27, 2012 at *http://www.uprr.com/customers/energy/coal/wyoming/blkbutte.shtml.*

Union Pacific, 2010b, Kemmerer Mine: Omaha, Neb., ©Union Pacific. Accessed on Jan. 27, 2012 at *http://www.uprr.com/customers/energy/coal/wyoming/kemmerer.shtml.*

Union Pacific, 2010c, Medicine Bow Mine: Omaha, Neb., ©Union Pacific. Accessed on Jan. 27, 2012 at *http://www.uprr.com/customers/energy/coal/wyoming/med_bow.shtml.*

Union Pacific, 2010d, Seminoe II Mine: Omaha, Neb., ©Union Pacific. Accessed on Jan. 27, 2012 at *http://www.uprr.com/customers/energy/coal/wyoming/seminoe.shtml.*

Union Pacific, 2010e, Shoshone Mine: Omaha, Neb., ©Union Pacific. Accessed on Jan. 27, 2012 at *http://www.uprr.com/customers/energy/coal/wyoming/shoshone.shtml.*

U.S. Bureau of Land Management (BLM), 2005, Draft environmental impact statement for the Atlantic Rim natural gas field development project: Wyoming State Office, Rawlins Field Office, Rawlins, Wyo. U.S. Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rfodocs/atlantic_rim.Par.61741.File.dat/00deis.pdf.*

U.S. Bureau of Land Management (BLM), 2007, Record of decision, environmental impact statement for the Atlantic Rim natural gas field development project Carbon County, Wyo. Accessed on Jan. 27, 2012 at *http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rfodocs/atlantic_rim/rod.Par.46558.File.dat/ROD.pdf.*

U.S. Bureau of Land Management (BLM), 2008a, Coal: Rock Springs, Wyo., Rock Springs Field Office: Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/field_offices/Rock_Springs/minerals/coal.html.*

U.S. Bureau of Land Management (BLM), 2008b, Wyoming wind energy project: Rawlins, Wyo., Rawlins Field Office, Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/field_offices/Rawlins/wind.html.*

U.S. Bureau of Land Management (BLM), 2009a, Chokecherry & Sierra Madre wind energy project: Rawlins, Wyo., Rawlins Field Office, Bureau of Land Management. Accessed on April 21, 2010 at *http://www.blm.gov/wy/st/en/info/NEPA/rfodocs/Chokecherry.html.*

U.S. Bureau of Land Management (BLM), 2009b, Surface & mineral status (ownership) for Wyoming: Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/resources/public_room/gis/metadata/own.html.*

U.S. Bureau of Land Management (BLM), 2010a, BLM Rock Springs schedules public meeting for the White Mountain wind project: Rock Springs, Wyo., Rock Springs Field Office, Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/info/news_room/2010/february/03rsfo-whitemtn-wind.html.*

U.S. Bureau of Land Management (BLM), 2010b, Environmental assessment for the White Mountain wind energy project, Sweetwater County, Wyoming: Rock Springs, Wyo., Wyoming High Desert District, Rock Springs Field Office, Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rsfodocs/whitemtn-wind/ea.Par.93226.File.dat/02EA.pdf.*

U.S. Bureau of Land Management (BLM), 2010c, Renewable energy—Wyoming: Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/programs/energy/renewable.html.*

U.S. Bureau of Land Management (BLM), 2010d, Competitive lease sale notices & results: Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/programs/energy/Oil_and_Gas/Leasing.html.*

U.S. Bureau of Land Management (BLM), 2011, Chokecherry & Sierra Madre wind energy project: Rawlins, Wyo., Rawlins Field Office, Bureau of Land Management. Accessed on Jan. 27, 2012 at *http://www.blm.gov/wy/st/en/info/NEPA/rfodocs/Chokecherry.html.*

U.S. Chamber of Commerce, 2011, Simpson Ridge wind farm project, Wyoming: Washington, D.C., U.S. Chamber of Commerce. Accessed on Jan. 27, 2012 at *http://www.projectnoproject.com/2010/12/simpson-ridge-wind-farm-project-wyoming/.*

U.S. Department of Energy, National Renewable Energy Laboratory, and AWS Truepower, 2010, Wyoming Annual Average Wind Speed at 80m: Washington, D.C., U.S. Department of Energy, Energy Efficiency and Renewable Energy . Accessed on March 5, 2012 at *http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=wy*

U.S. Department of Labor, 2011, Mine data retrieval system: Mine Safety and Health Administration, U.S. Department of Labor. Accessed on Jan. 27, 2012 at *http://www.msha.gov/drs/drshome.htm.*

U.S. Energy Information Administration (EIA), 2010, Independent statistics and analysis, State energy profiles, Wyoming, June 3, 2010: Washington, D.C., U.S. Department of Labor. Accessed on Jan. 27, 2012 at *http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=WY.*

U.S. Geological Survey Fort Union Coal Assessment Team, 1999, Resource assessment of selected Tertiary coal beds and zones in the northern Rocky Mountains and Great Plains region: U.S. Geological Survey Professional Paper 1625–A, v. 1.2. Available at *http://pubs.usgs.gov/pp/p1625a/.*

U.S. Geological Survey Southwestern Wyoming Province Assessment Team, 2005, Petroleum systems and geologic assessment of oil and gas in the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, v. 1.0. Available at *http://pubs.usgs.gov/dds/dds-069/dds-069-d/.*

Vetter, W.E., and Beam, J.M., 1999, Accident investigation report (surface coal mine), fatal machinery accident, Jim Bridger Coal Mine (ID no. 48–00677), Bridger Coal Company, Rock Springs, Sweetwater County, Wyoming: United States Department of Labor, Mine Safety and Health Administration. Accessed on Jan. 27, 2012 at *http://www.msha.gov/FATALS/1999/FTL99C21.HTM.*

Weimer, R.J., 1970, Rates of deltaic sedimentation and intrabasin deformation, Upper Cretaceous of the Rocky Mountain region, *in* Morgan, J.P., ed., Deltaic Sedimentation, Modern and Ancient: Society of Economic Paleontologists and Mineralogists Special Publication 15, p. 270–292.

Whitman, G.B., 1992, Steeply dipping bituminous coal—Kemmerer mine, *in* Hartman, H.L., 1992 SME Mining Engineering Handbook, 2nd ed., v. 2, p. 1392–1395.

Wind Power, 2010, Dunlap Wind Farm, Wyoming: Phoenix, Ariz.: ©Renewable Energy Development, Inc. Accessed on Jan. 27, 2012 at *http://renewableenergydev.com/red/wind-power-dunlap-wind-farm-wyoming/.*

WyGISC, 2002, Coal mine locations and production in tons 1999 for Wyoming: Laramie, Wyo., University of Wyoming Dept. of Geography. Accessed on Jan. 27, 2012 at *http://wygl.wygisc.org/wygeolib/catalog/search/viewMetadataDetails.page?uuid=%7B7D435D4B-2334-4EDD-A6FD-504613FC6831%7D.*

Wyoming Coal Information Committee, 2006, A concise guide to Wyoming coal, 2006: Wyoming Mining Association. Accessed on Jan. 27, 2012 at *http://wyocre.uwagec.org/Publications/Concise%20Guide%202006.pdf.*

Wyoming Community and Regional Economics Portal, 2010, Home page: University of Wyoming, Department of Agricultural and Applied Economics and the University of Wyoming Cooperative Extension Service. Accessed on Jan. 10, 2012 at *http://agecon.uwyo.edu/Econdev/PubStorage/Concise%20Guide%202006.pdf.*

Wyoming Department of Environmental Quality, 2011, Land Quality Division, cumulative hydrologic impact assessments—Coal mining: Cheyenne, Wyo., Wyoming Department of Environmental Quality. Accessed on Jan. 27, 2012 at *http://deq.state.wy.us/lqd/#CHIA.*

Wyoming Department of Revenue, 1999, Wyoming State Railroads: Cheyenne, Wyo., Wyoming Department of Revenue. Accessed on Jan. 27, 2012 at *http://cama.state.wy.us/districts/mapdocs/METADATA/STARAI02.HTM.*

Wyoming Mining Association, 2010, Wyoming Coal: Cheyenne, Wyo., Wyoming Mining Assocciation. Accessed on Jan. 27, 2012 at *http://www.wma-minelife.com/coal/coalhome.html.*

Wyoming Oil and Gas Conservation Commission (WOGCC), 2010, Home page: Casper, Wyo., Wyoming Oil and Gas Conservation Commission. Accessed on Jan. 27, 2012 at *http://wogcc.state.wy.us/.*

Wyoming State Geological Survey (WSGS), 2010a, Wyoming coalbed natural gas: Wyoming State Geological Survey. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/Topics/CBM/.*

Wyoming State Geological Survey (WSGS), 2010b, News Release–WSGS releases Atlantic Rim CBNG map: Wyoming State Geological Survey. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/News/Jan25_2010.aspx.*

Wyoming State Geological Survey (WSGS), 2010c, Wyoming geology—Hanna-Carbon Basin: Wyoming State Geological Survey. Accessed on Jan. 27, 2012 at *http://www.wsgs.uwyo.edu/StratWeb/HannaBasin/Default.aspx.*

Yun, Yongseung, Jakab, Emma., McClennen, W.H., Hill, G.R., and Meuzealaar, H. L.C., 1987, The role of aliphatic and aromatic coal structures and macerals in low temperature coal oxidation processes: Division of Fuel Chemistry, American Chemical Society 1987 Spring meeting: Washington, DC. Accessed on Jan. 27, 2012 at *http://www.anl.gov/PCS/acsfuel/preprint%20archive/Files/Merge/Vol-32_1-0004.pdf.*

Publishing support provided by:
Denver Publishing Service Center

For more information concerning this publication, contact:
Center Director, USGS Central Energy Resources Science Center
Box 25046, Mail Stop 939
Denver, CO 80225
(303) 236-1647

Or visit the Central Energy Resources Science Center Web site at:
http://energy.cr.usgs.gov/

Biewick and Jones—**Energy Map of Southwestern Wyoming, Part A—Coal and Wind**—Data Series 683