

Wyoming's Electrical Generation

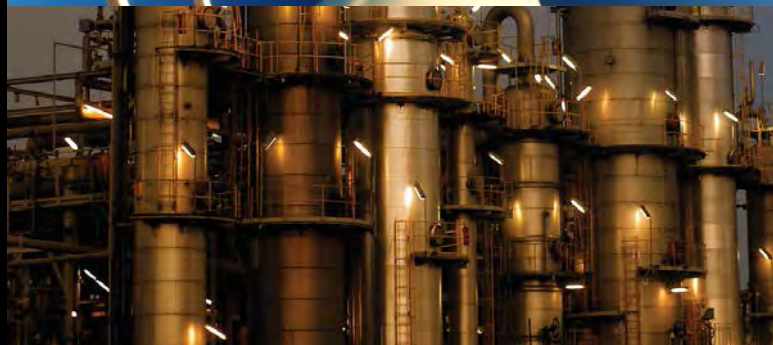
Summary Report

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Wyoming State Geological Survey



Introduction

Wyoming is a state with a wealth of energy resources. Many of these resources are used for generating electricity for the state and nation's energy needs. The Wyoming State Geological Survey (WSGS) has developed a website on Wyoming's electrical power generation. This information portal includes regularly updated electrical generation energy sources and locations (www.wsgs.uwyo.edu). This public information report is a snapshot on the current state of Wyoming's electrical generation and includes 2009/2010 data collected by the United States Energy Information Administration (EIA).

Wyoming ranks second in the nation as the largest supplier of energy resources (EIA, 2009). It is also the largest U.S. exporter of these extracted energy resources, which provide the nation with more than 10 quadrillion British Thermal Units (BTUs) of energy per year (WSGS CGRD-6, 2008).

Wyoming is the largest coal and uranium producer in the nation and is also a leading producer of oil and natural gas. Despite the state being the leading U.S. producer of uranium at 0.36 quadrillion BTUs per year (Cameco, 2010), Wyoming does not currently produce nuclear power generation. The majority of Wyoming's power generation comes from coal, but a significant and

increasing amount is generated from wind and natural gas, along with a consistent and established hydropower generation.

In 2011, Wyoming's total electrical generation capacity was 8,744.4 megawatts (MW), with 77 percent generated from coal, 16 percent from wind, 3 percent from natural gas, 3 percent from hydropower, and 1 percent from oil. This electrical generation capacity comes from 53 facilities throughout the state. The majority of the state's electrical generation is transferred out-of-state because the electric power demand within Wyoming is relatively low.

Coal

With the majority of electric energy in the state derived from coal-fired generation, Wyoming's coal resources provide the state and nation with a substantial and steady electricity source. In addition, power plants that utilize coal as a primary fuel for their own operations are able to operate very large generators at a low fuel cost. Wyoming has 13 coal-fired power plants, with one for internal use and 12 that provide generation for electric utility companies. These power plants include Black Hills Power (6), Pacificorp/Rocky Mountain Power (4), and Basin Electric (2). The total generation capability of coal-fired generators in Wyoming is 6,747.8 MW. The five

largest producers are Jim Bridger (2,317.7 MW), Laramie River Station (1,710 MW), Dave Johnston (816.7 MW), Naughton (707.2 MW), and Dry Fork Station (385 MW).

Wind

Wyoming ranks tenth in the nation for overall installed wind capacity and it has the eighth highest potential of wind energy resources (AWEA, 2011). While in the last few years wind power generation has rapidly increased, it has relatively low efficiency in terms of the amount of MWs generated to use for electric energy. Despite this fact development and the overall number of Wind Turbine Generators (WTG) in Wyoming has increased in the last several years. Currently, there are 14 wind power projects broken up into 29 phases of construction and/or producing units. The utilities with the most WTG projects are PacifiCorp/Rocky Mountain Power (4), Duke Energy (4), and WTG projects owned by other utilities/companies (7). The total wind power production capacity of Wyoming wind farms is 1,415.1 MW. From 2000 to 2011, the amount of wind energy installed in Wyoming increased from 90 MW to more than 1,000 MW (AWEA, 2011).

Wind energy now comprises 16 percent of the generation capacity and more than 6 percent of the total electricity generated in the state in 2011 (AWEA, 2011). The five largest wind farms by capacity are Glenrock-Rolling Hills (237 MW), Top of the World (200.2 MW),

Few states in the nation possess the portfolio Wyoming has for both energy resources and electric power generation.

Wyoming Wind Energy Center (144 MW), Mountain Wind (140.7 MW), and High Plains-McFadden (127.5 MW).

Hydropower

Wyoming has a long history of hydropower dams, dating back to the early 1900s. While hydropower generation is considered small and seasonal, it represents a consistent and established electricity source. There are 15 hydropower plants on 10 reservoirs. Thirteen of these are operated by the Bureau of Reclamation and two by private companies. The total hydropower generation capacity in Wyoming is 299.6 MW. The five largest producers are Fremont Canyon/Pathfinder (66.8 MW), Seminoe (51.6 MW), Alcova (41.4 MW), Glendo (38 MW), and Kortess (36 MW).

Natural Gas/Petroleum

Currently, Wyoming is the second leading producer of natural gas and the seventh leading producer of oil in the United States (EIA, 2010). Nearly all of the state's oil and gas is exported via pipeline and offers a convenient fuel for on-site industrial electrical generation. Oil and gas-fueled generation, while small in comparison to coal, remains constant. Especially noteworthy is that nationwide utilities are increasingly using natural gas over coal for electric

power generation because of its lower emissions.

Currently, there are eight natural gas power projects and three fuel-oil generators operating in Wyoming. Five of the natural gas generators are used to generate electricity for internal use; three of these generators are used by Basin Electric utility and one by Black Hills Power.

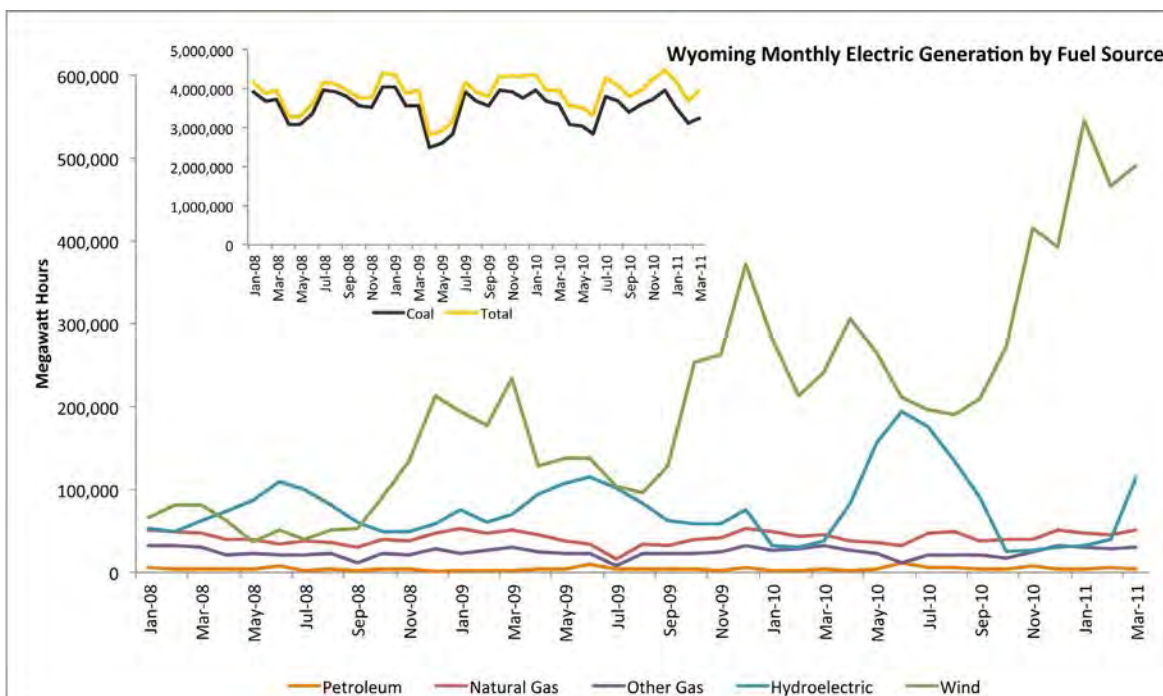


Figure 1. Electrical generation produced in Wyoming by each fuel source. (Modified from EIA Wyoming Electricity Profile, Table 5.)

The total natural gas generation capability for the state is 274.0 MW. The five largest generators are Shute Creek Gas Plant (108 MW for internal use), Neil Simpson Gas Turbines (80 MW), and Barber Creek/Arvada/Hartzog (22.5 MW each).

Wyoming's three fuel-oil plants have a total capacity of 7.9 MW, with two used for utility and one for internal use. Sinclair Oil Refinery operates a 3.2 MW generator, and Yellowstone National Park operates two power plants, Yellowstone Lake (2.7 MW) and Old Faithful (2.0 MW).

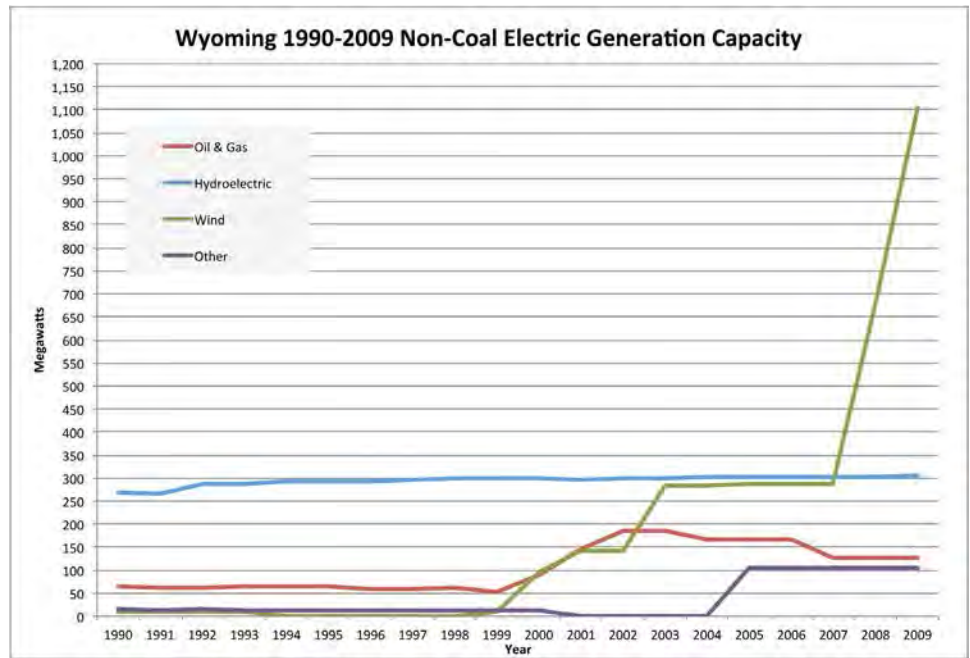


Figure 2. Electrical generation capacity in Wyoming by fuel sources other than coal. (Modified from EIA Wyoming Electricity Profile, Table 4.)

Electrical Generation

Over the past few years Wyoming's monthly power generation has fluctuated between 2.75 and 4.50 million MW hours (Figure 1). Generation is higher during the cold winter months in order to meet an increase in demand for electricity. Wind generation also peaks during the winter months when wind speeds are high.

A summary of Wyoming's total electrical generation as well as the sources are included in Figure 3. The capacity of the various fuel types and the actual generation from each one provides some insight into the energy efficiency of each energy source. Coal represents 78 percent of the total capacity; however, it accounts for 91 percent of the actual generation, highlighting the inconsistent nature of other power sources.

Summary

Wyoming is one of the most important energy providers in the country, including electrical power generation. However, the state is currently at maximum transmission capacity. Any addition of generation resources would require the development of new power

| Fuel Type | Generation Capacity (MW) | % of Total Capacity | Net Generation (MW) | % of Total Net Generation | % of Capacity Generated |
|--------------------------|--------------------------|---------------------|---------------------|---------------------------|-------------------------|
| Coal | 5,929.0 | 78.4% | 4,789.3 | 91.1% | 80.8% |
| Petroleum | 7.0 | 0.1% | 5.7 | 0.1% | 81.8% |
| Natural Gas | 120.0 | 1.6% | 55.7 | 1.1% | 46.4% |
| Other Gases ¹ | 92.0 | 1.2% | 32.5 | 0.6% | 35.3% |
| Hydroelectric | 304.0 | 4.0% | 110.3 | 2.1% | 36.3% |
| Wind | 1,104.0 | 14.6% | 254.1 | 4.8% | 23.0% |
| Other ² | 12.0 | 0.2% | 6.8 | 0.1% | 56.7% |
| Total | 7,566 | 100.0% | 5,254 | 100.0% | 69.4% |

¹Other gases includes blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels. ²Other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels and miscellaneous technologies.

Figure 3. Generation efficiency by capacity and net generation for 2009. (Modified from EIA Wyoming Electricity Profile, Tables 4 and 5.)

lines for exporting Wyoming's electrical generation to other markets (BLM, 2010).

Coal has and will continue to be Wyoming's major generation fuel for internal use as well as for export. Wind power capacity and use has increased significantly over the past decade and has the potential to increase furthermore. Hydropower capacity is important, yet represents a relatively modest contributor. Natural gas as a power generation fuel could see significant growth in the coming years, and given its abundant reserves and production of natural gas, Wyoming will likely be a significant contributor to those efforts in the future.

As the nation works to diversify and grow its energy portfolio and power supply, Wyoming should play an important and perhaps increasing role in electrical generation.

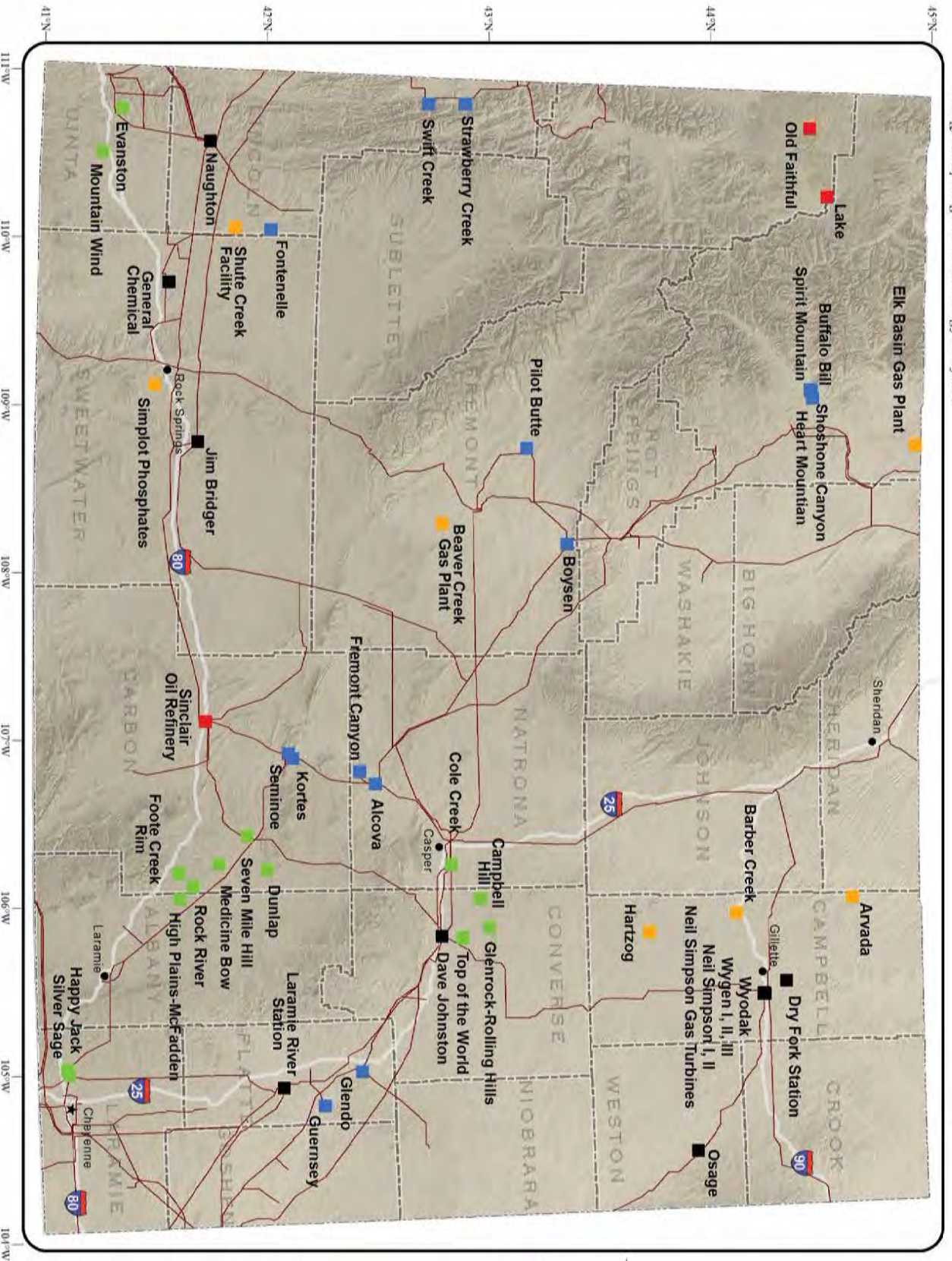
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WYOMING STATE GEOLOGICAL SURVEY
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Geology - Interpreting the Past - Providing for the future



Wyoming Electrical Generators (Power Plants, Processing Plants, Wind Farms)

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EXPLANATION

- COAL
- NATURAL GAS
- FUEL OIL
- HYDROPOWER
- WIND
- POWER LINES ≥ 115 KV
- CITY OR TOWN
- INTERSTATE HIGHWAY
- COUNTY BOUNDARY

0 10 20 40 Miles

N

Cover photos of wind energy and natural gas courtesy of the UW School of Energy Resources.