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Utah's Coal Counties

Part I: Coal Energy, Production, and the Future



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The mission of Utah Foundation is to promote a thriving economy, a well-prepared workforce, and a high quality of life for Utahns by performing thorough, well-supported research that helps policymakers, business and community leaders, and citizens better understand complex issues and providing practical, well-reasoned recommendations for policy change.

Utah's Coal Counties

Part I: Coal Energy, Production, and the Future

Most coal consumption in the United States is for electricity generation. However, coal-fueled electricity's share of the total has been decreasing. This is due in large part to the availability of low-cost natural gas, stringent environmental regulations that affect coal-fueled power plants, and favorable tax treatment for renewable technologies. Coal-fueled power plants have been closing and others are reducing their total output. As a result, coal production is also decreasing.

Utah is one of only six states that gets more than two-thirds of its electricity from coal. Utah Foundation analysis shows that states with a higher percentage of coal power tend to have lower electricity prices than those states with a lower percentage. However, this may change given that natural gas, wind, and solar projects are cheaper to develop and maintain than coal projects.

Part I: Coal Energy, Production, and the Future
Part II: Coal Mines, Jobs, and Economic Benefit
Part III: Coal Communities

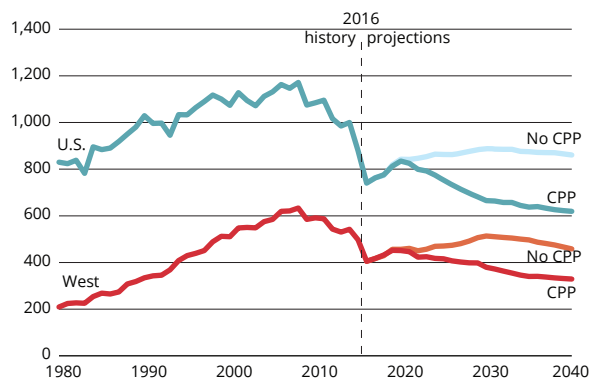
In fact, coal projects that are retiring across the country are not typically being replaced by other coal projects, but with natural gas and renewables. Utah is following that trend. For instance, the Intermountain Generating Station's coal-fueled turbines in Millard County may be retired by 2025 when the company completes construction of its natural gas turbines.

These trends are not likely to reverse under the current presidential administration, even given the likely unwinding of the previous administration's environmental and climate change measures which put a burden on coal-fueled power plants. Nonetheless, demand for coal may increase in the short term with an expected increase in natural gas prices.

KEY FINDINGS:

- Coal production has been declining in Utah for years. In 2015, production was just over half of what was produced in 2001.
- States with a greater proportion of coal power in their mix of electricity generation tend to have lower electricity prices.
- Utah is fifth highest in the nation for percentage of coal-fueled electricity in its mix of electricity generation.
- The cost of electricity from natural gas, wind, and solar is now typically lower than operating, maintaining, and upgrading coal-fueled resources.
- Natural gas electricity production surpassed coal nationally in 2015. Utah is trending that direction with the recent closure of one electricity plant and possible timelines for ceasing coal-fueled operations at two others.

Projected Coal Production by Status of Climate Change Measures from the Clean Power Plan (CPP), millions of tons



Source: U.S. Energy Information Administration.

This report was written by Utah Foundation Research Director Shawn Teigen. He can be reached for comment at 801-355-1400, extension 3, or by email at shawn@utahfoundation.org. Thanks to those who provided insight and reviewed Part I of this report, including John Ward, spokesman for Intermountain Power Agency, and Ian Andrews, Director of Resource Development at PacifiCorp. Special thanks to Intermountain Power Agency for proving financial support to this project.

Mining is important in Utah. Coal mining is no exception. Of Utah's \$7 billion to \$10 billion value in mineral and energy resource production, coal accounts for 5% to 10% – more than \$500 million each year since 2005.¹ Accordingly, coal plays an important role in the state's economy, but is particularly important in a handful of rural Utah counties. Most of Utah's coal production is of the bituminous variety (pronounced emphasizing the “u” as “you”).

COAL USAGE

Coal has many uses. Most coal is pulverized and combusted to create steam used in generating electricity.

It is also used to create the high-temperatures needed to make cement (1,450°C) and steel (1,000-1,100°C).² In Utah, however, the main non-utility coal user is Kennecott Utah Copper Corp., in Salt Lake County (Utah County's Geneva Steel permanently discontinued coal power generation and coking operations in 2002).³

Coal – Utah's state rock – originates as plant matter. Bacteria breaks down the matter in wetlands which is then converted to peat. If buried, the peat begins to heat and force out water and methane gas leaving a higher content of carbon. As heat and pressure increase, the peat is converted into lignite, then subbituminous coal, then bituminous coal, and finally anthracite, in order of increasing metamorphic conversion.

Around the world, coal is also converted to gasoline, diesel, and aviation fuel in a coal-to-liquid fuel process. Coal's byproducts are useful as well. One byproduct of coal combustion is fly ash, which can be used in making cement and concrete. Gypsum – used in manufacturing wallboard – is also a byproduct of some flue gas desulfurization processes. New uses of coal are still being explored. These uses are discussed in Part III of this report.

Decreasing U.S. Coal Power Generation

U.S. coal consumption declined by 13% in 2015 from the previous year, and declined another 17% in 2016.⁴ This decline is primarily the result of a decrease in U.S. coal-fueled electricity generation. However, it is expected to increase over the next few years coinciding with an expected increase in natural gas prices.⁵

In the U.S., over 90% of coal is used in the electric power sector.⁶ Power plants use 738,071,000 tons per year while other industrial operations use only 59,670,000 tons.⁷

The primary measure of electricity produced by power plants is the watt. This report typically uses megawatts (or “MW”) – equal to one million watts. One megawatt hour (“MWh”) is the amount of electricity used continuously for a one hour period. The U.S. generates over four billion (4.076 billion) megawatt hours per year for residential, commercial, and industrial uses, each of which is roughly equal in its electricity usage.⁸

In 2015, about two-thirds of the U.S.'s four billion megawatt hours of electricity generated was from fossil fuels.⁹ Coal was the largest producer of electricity in the U.S. before it was surpassed by natural gas in 2015 (see Figure 1).¹⁰ In fact, during the first half of 2016, natural gas produced 36% of the nation's power, compared to coal's 31%.¹¹

An increasing share is also being produced from renewable sources – primarily wind power. Coal's share is not only decreasing, but the total number of megawatt hours generated by coal is decreasing as well.

Natural Gas Catches Coal in U.S.

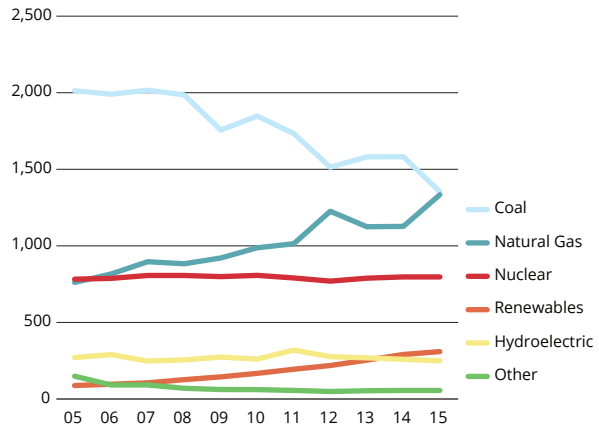
U.S. Electricity Generation Mix, 2015

- Coal = 33%
- Natural gas = 33%
- Other fossil fuel = 1%
- Nuclear = 20%
- Hydropower = 6%
- Renewables = 7%
 - Biomass = 1.6%
 - Geothermal = 0.4%
 - Utility-scale solar = 0.6%
 - Wind = 4.7%

*Note: Preliminary data.
Source: U.S. Energy Information Administration.*

The decline in coal's market dominance is due in part to a combination of the low price of natural gas, improvements in renewable power generation technology, renewable subsidies, increasing environmental regulation of coal, and state, local, and customer mandates for renewable resources to replace carbon-based sources of electricity.

Figure 1: Electricity Transition: Net Generation by Energy Source, millions of megawatt hours, U.S.



*Note: "Other" includes sources such as other gases and petroleum.
Source: U.S. Energy Information Administration.*

Electricity Generation and Consumption

In 2015, the average yearly electricity consumption for a U.S. residential utility customer was 11 megawatt-hours.¹² Utahns used 9 megawatt hours per year, while hot Southern states used the most, and temperate Hawaii used the least. On average, electricity sales have increased by 4.1% per year in Utah, though sales dipped slightly in 2015 (only the fifth time annual sales have declined in the past 50 years).¹³

In 2015, coal-fueled power plants generated 76% of Utah's electricity.¹⁴ There are five coal-fueled power plants in Utah serving utility customers. The largest, Intermountain Power Plant in Millard County, sells most of its power to six municipalities in Southern California; it has a generating capacity of 1,800 MWs.¹⁵ The Hunter (1,363 MWs) and Huntington (909 MWs) plants in Emery County, the Bonanza (500 MWs) plant in Uintah County, and the Sunnyside Cogen (53 MWs) waste coal plant in Carbon County mainly provide electricity to the energy grid powering Utah, but also portions of Idaho, Wyoming, and Nevada.

Coal Dominates in Utah

Utah Electricity Mix, 2015

- Coal = 76%
- Natural gas = 20%
- Other fossil fuel = 0%
- Nuclear = 0%
- Hydropower = 2%
- Renewables = 2%
 - Biomass = 0.2%
 - Geothermal = 1.0%
 - Utility-scale solar = 0.2%
 - Wind = 1.5%

Source: U.S. Energy Information Administration.

Electricity generation from natural-gas power plants more than doubled with the development of the Lake Side Power Station in 2007 and an additional 645 MW of generating capacity at Lake Side 2 in 2014.¹⁶ Natural-gas accounted for nearly 20% of Utah's electricity generation in 2015.

More natural gas power is expected to come online in the near future. The Intermountain Generating Station in Millard County may discontinue its coal-fueled operations when it brings its expected natural gas generating units online in 2025. This transition to natural gas is the result of California Assembly

Bill 32 requirements for a reduction in greenhouse gas emissions which natural gas units produce at lower levels than coal-fueled units.

In 2014, the Ute Indian Tribe announced the development of a 1,000MW natural gas power plant on Uintah and Ouray Reservation land in the Uintah Basin.¹⁷ Its output would be roughly equivalent to the large Huntington plant in Emery County.

There are numerous other sources of hydro and renewable energy in the state. Hydropower has a generating capacity of 286MW in Utah, over half of which comes from the dam at Flaming Gorge reservoir.

Utility-scale solar has a generating capacity of 165MW, with an additional 681MW proposed, mostly in Beaver, Iron, and Millard counties. Wind has a generating capacity of 387MW, with 180MW more proposed, mostly from the First Wind project in Beaver and Millard counties.

Geothermal has a generating capacity of 84MW, with another 30MW proposed. Utah is one of only seven states with geothermal power generation.¹⁸ The Blundell Plant near Milford is one such site generating 33 MW by drawing boiling water from the Roosevelt Hot Springs and using its steam to turn a turbine. Biomass in Utah has a generating capacity of 13MW.¹⁹

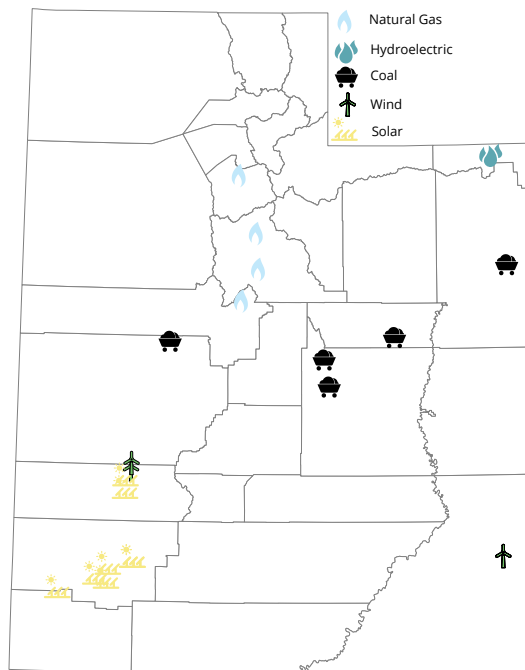
Cost of Coal Power

The average sales price of Utah coal in 2015 was \$34.53 per ton. This is down from an inflation-adjusted price of \$97 in the mid-1970s but up from an inflation-adjusted price of just over \$21 in the mid-2000s.²⁰ The national average was \$31.83 in 2015, down 8.6% from the previous year, and Wyoming was only \$13.92.²¹ The cost of coal naturally affects electricity prices from coal-fired power plants.

Utah Foundation analysis shows that states with a larger percentage of coal power typically have lower electricity prices than states with a smaller percentage of coal power (see Figure 3). West Virginia, with the highest percentage of coal power in the U.S., has one of the lowest electricity prices in the nation. Like West Virginia, Utah's use of coal as a total percentage of its consumption is high, and enjoys relatively low electricity prices. All but one state with higher than average coal usage (32%) have electricity prices that are below average (\$0.20).

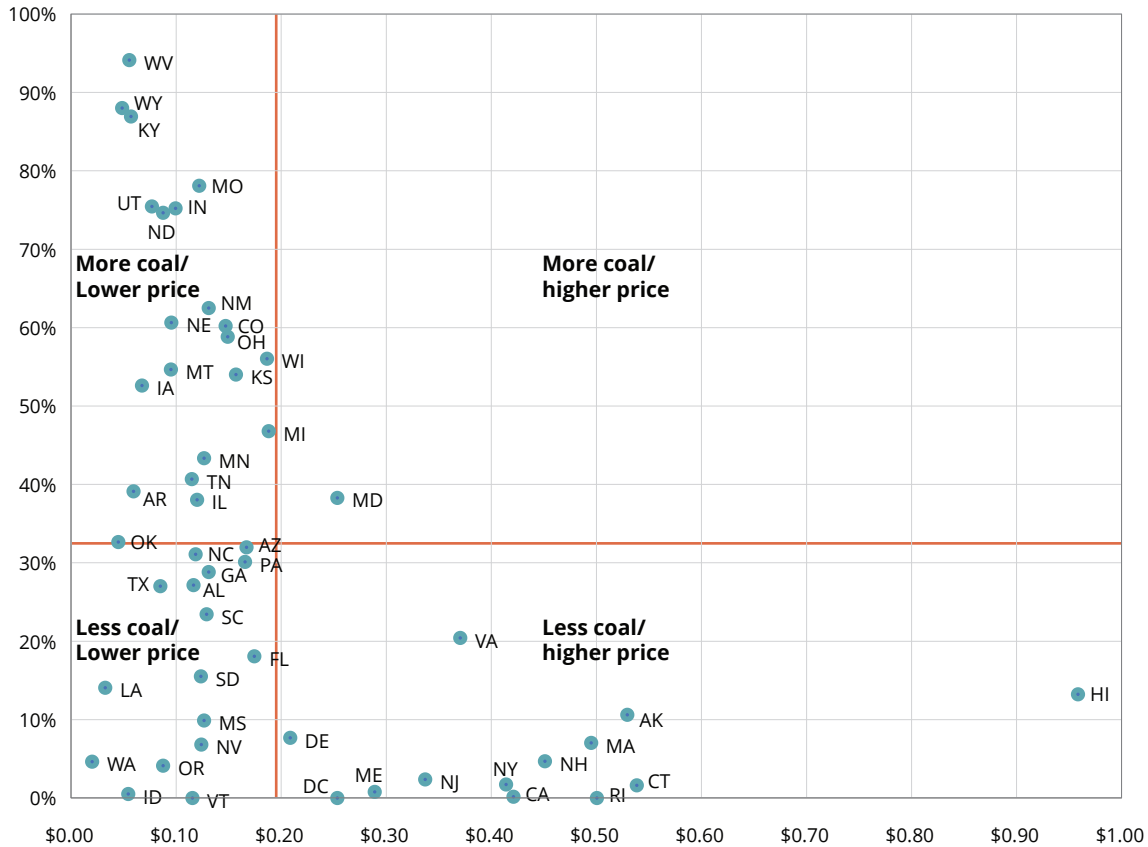
As discussed further in this part and other parts of this report, it is becoming cost prohibitive to operate some coal plants and open new ones, and energy demands are changing. Further, natural gas prices are low – though are expected to rise – and the cost of constructing natural gas plants are lower than coal-fueled ones. Renewable power development also continues to become less costly – particularly with favorable tax regulations.

Figure 2: Utah's 15 Largest Electricity Providers, 2015 – all over 50 MW generating capacity



Source: Utah AGRC and U.S. Energy Information Administration.

Figure 3: States with More Coal-Fueled Electricity Tend to Have Lower Electricity Prices



Source: Data from U.S. Energy Information Administration.

Accordingly, future results of this type of analysis may show different electricity profiles with lower prices. There are plenty of current examples with electricity profiles which do not emphasize coal but which have below average prices. Some such examples are Washington State, Oregon, South Dakota, Idaho, and Vermont, which are all have lower than average coal usage but lower than average prices; each has an electricity profile with over 50% hydroelectric power. The two states with greater than 50% nuclear electricity are lower than average in price. Those states with over 50% natural gas are scattered between having electricity with lower than average prices and higher than average – such as California.

COAL PRODUCTION

Like the decline in coal consumption in 2015, U.S. coal production decreased by 10.3% from 2014, which is the lowest production level since 1986.²² Production is expected to have dropped again in 2016, but is expected to increase in over the next several years as the “as a projected rise in natural gas prices improves the competitiveness of existing coal generating units.”²³

Production in the West, which accounts for 57% of the U.S. total, was 6.5% lower in 2015 than in 2014.²⁴ Wyoming produces 41.9% of the coal mined in the nation.²⁵ Utah accounts for only 1.6% of U.S. production.²⁶ Utah production has been trending downward over the past 15 years, with production in 2015 just over half of what it was in 2001 (see Figure 4).

This decline is occurring even though Utah is considered to have an overall “investment attractiveness.”²⁸ Utah ranks ninth in the world based upon ease of extraction and governmental policy on attitudes toward exploration investment. Utah’s decline is due to decreases in coal-fueled power generation – most of Utah’s coal is used in the state’s large power plants, with some distribution to western states for power and other industrial uses.²⁹

Utah’s coal is produced from eight mines in four Utah counties. Most of Utah’s mines are underground – though the Alton Mine in Kane County is primarily a surface operation. Further discussion of Utah’s mines is in Part II related to employment.

Coal Reserves

When considering coal reserves, Utah mines – and those across the United States – could continue to produce coal far into the future. U.S. has over one-quarter of the coal reserves in the world.³⁰ The nation’s recoverable coal reserves are over 255 billion tons.³¹ These recoverable amounts are about half of the “demonstrated reserve base,” the latter of which includes lands that are tied up due to land use conflicts, property rights, physical constraints, and environmental restrictions.³² Of the recoverable tonnage, approximately 9% is in producing mines.³³

Figure 5: Utah Coal Production by County, in tons, 2015

	Underground		Surface		Total	
	Number of Mines	Production	Number of Mines	Production	Number of Mines	Production
Carbon	4	7,101,000	0	0	4	7,101,000
Emery	2	967,000	0	0	2	967,000
Kane	1	11,000	1	316,000	2	327,000
Sevier	1	6,024,000	0	0	1	6,024,000
State of Utah	8	14,103,000	1	316,000	9	14,419,000

Source: U.S. Energy Information Administration.

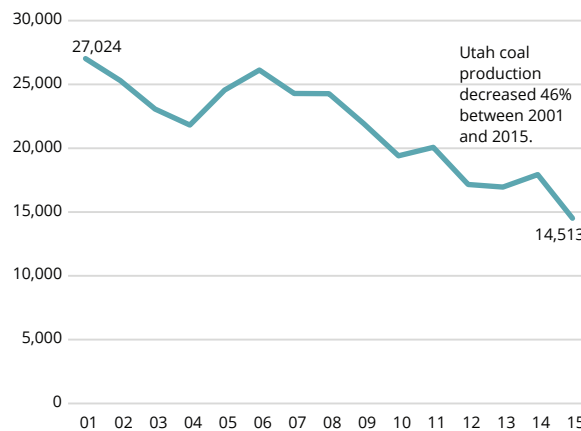
In 2015, Utah’s mines had just under 128 million tons of estimated recoverable coal reserves under lease, down from over 350 million in the early 2000s.³⁴ Utah’s recoverable coal reserves in all areas are estimated at 2.5 billion tons.³⁵

FUTURE OF COAL ENERGY

The Utah Geological Survey has determined that “coal production declines are mostly demand related.”³⁶ The question is how much electricity will be generated from coal-fueled power plants in the U.S. and Utah in future years.

When adjusting for inflation, natural gas prices are lower than they have been in 40 years.³⁷ This is due in part to hydraulic fracturing – or fracking – to increase gas production. However, the U.S. Energy Information

Figure 4: Utah Annual Coal Production, millions of tons



Note: Estimate for 2016 is 14,100.²⁷
Source: Utah Geological Survey.

Administration suggests that natural gas prices will increase in the coming years.³⁸ That could increase demand for coal.

Construction of coal-fueled power plants is currently more expensive than other power sources. Part of the expense for coal plants is due to environmental regulations. Figure 6 shows that not only are coal plants with the newer carbon capture and storage technology expensive to build, but they also have comparatively high operational and maintenance costs.³⁹ Natural gas, wind and solar energy generation methods are far less expensive from a construction standpoint and when looking at ongoing costs. Furthermore, it takes a four-year lead time to construct coal plants, while other energy generation plants are estimated to take two to three years. Overall development time is also longer for coal plants, even before construction begins.

Environmental Protection Agency

The Environmental Protection Agency (EPA) has been implementing rules and regulation on coal for decades, and more recently has been focusing on greenhouse gas emissions. This is in part due to the U.S. being the second greatest emitter of greenhouse gases in the world (after China but before the European Union).⁴⁰ When considering greenhouse emission per capita, the U.S. is second only to Canada.⁴¹

One EPA rule from 2015 is the “Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units.” Under this rule, newly constructed plants must emit less than 1,400 pounds of CO₂ per megawatt hour of electricity produced, while large reconstructed plants must be under 1,800 pounds.⁴² “Most of Utah’s coal-fueled power plants – with the possible exception of the Intermountain Generating Station – are above this standard.”⁴³

In 2015 President Obama proposed the “Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units,” otherwise known as the Clean Power Plan (CPP). The plan would limit carbon dioxide emissions on coal and natural gas power plants to reduce greenhouse. The plan also aimed to reduce other air pollutants, such as sulfur dioxide and nitrogen oxides which form particulate matter and ozone. The final rule was released on October 23, 2015. On February 9, 2016, the Supreme Court granted a stay against the Clean Power Plan, halting implementation of a part of Section 111(d) of the Clean Air Act.⁴⁴

The EPA estimates that Utah’s 2012 CO₂ emissions were 1,874lbs/MWh and will be 1,779lbs/MWh in 2020. The CPP puts an interim and final 2030 goal for Utah at 1,379lbs/MWh and 1,179lbs/MWh, which would make compliance difficult. Another method to comply with the CPP is to take Utah’s total power plant emissions from 31 tons in 2012 to 24 tons in 2030. One way to reach CPP goals would be by emissions trading. It is expected that the new president will sign an executive order to modify the CPP in March 2017.⁴⁵

Carbon Capture Storage

Carbon capture storage adds costs to the development of coal plants. Figure 6 shows costs with a 30% capture. Not listed in the table are plants with 90% capture which cost 10% more in construction costs. No only do costs increase, but net output decreases.

Figure 6: Cost of New Utility-Sized Power Generation in Utah Region, 2016

	Construction \$/kW	Operations and Maintenance	
		Fixed \$/kW/yr	Variable \$/MWh
Coal plant (with 30% carbon capture storage)	5,177	70	7
Natural gas	718 - 2,227	10 - 33	2 - 10
Wind	2,006	47	n/a
Solar (photovoltaic)	1,615	23	n/a

Note: Capital costs do not include investment tax credits.
Source: US Energy Information Administration, Western Electricity Coordinating Council / Northwest Power Pool Area.

Carbon capture storage strips CO₂ from power plants emissions and sequesters it underground. There are also oil production benefits of carbon capture storage through CO₂-enhanced oil recovery. This is a process that increases production of old oil wells by injecting compressed CO₂ into the oil field. The CO₂ pushes the oil to the surface, but remains underground afterward, sequestering greenhouse gasses.⁴⁶ The University of Utah's Clean and Secure Energy is working on "scientific and technical breakthroughs to utilize the vast energy stored in our domestic coal resources and to do so in a manner that will capture the CO₂."⁴⁷

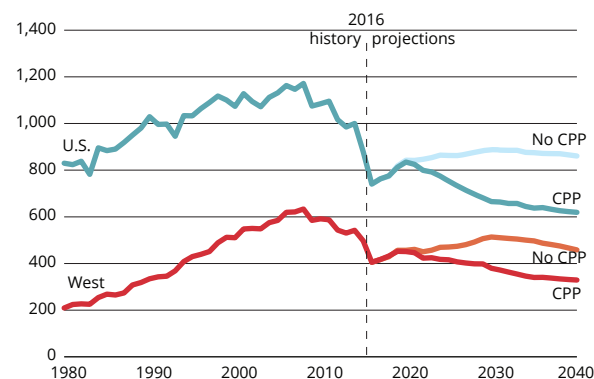
If the current administration is attempting to "bring back coal," it may attempt to remove carbon capture storage requirements on new power plants. However, there are some suggestions that carbon capture storage will actually expand given the current administration's touting of the expansion of "clean coal."⁴⁸

Current Administration

A big question is whether coal production might increase under the Trump administration. With a repeal of the CPP, the EIA estimates that coal production would be higher starting in 2020.⁴⁹ Increases in coal usage to 2020 in both the CPP and non-CPP scenarios shown in Figure 7 are the result of an expected increase in natural gas prices.

Former EPA Director Gina McCarthy has stated that she had to provide a scientific rationale for curbing CO₂ emissions. In the same way, under the Clean Air Act, the current administration would "have to figure out why the climate science isn't overwhelming and go back all the way to the Supreme Court to explain why decisions we've already made are no longer correct, and I wouldn't want to have that burden myself."⁵⁰ Though the issue extends to whether the EPA overstepped its authority in the structure of the CPP by setting state-specific greenhouse gas emission limits.⁵¹ But the demise of the CPP does little in the face of economics and the other regulations and requirements that have an impact on the coal-fueled electricity industry.

Figure 7: Projected Coal Production by Status of the Clean Power Plan, millions of tons



Source: U.S. Energy Information Administration.

U.S. and International Coal Power Plant Closures, and New Plants

On February 13, 2017, the owners of the Navajo Generating Station on the Navajo Indian Reservation, near Page, Arizona, decided to shut the plant at the end of 2019, though it could close even sooner.⁵² This is the largest plant west of the Missouri River. Representatives of the Navajo and Hopi Nations are seeking federal intervention to keep the plant open because of the effect that the plant closure would have on the community; it will eliminate approximately 800 jobs at the plant and the coal mine from which it procures its coal. This is just one such case.

Between 2016 and 2020, the U.S. expects the development of five new coal plants, but 93 closures, for a net loss of 88 plants losing generating capacity of 16,192 gigawatts.⁵³ Over this period, there is an expected net gain of 281 natural gas plants with a generating capacity of 54,872 gigawatts, 178 utility-sized wind projects with a generating capacity of 22,544 gigawatts, and 563 utility-sized solar projects with a generating

capacity of 14,493 gigawatts. Rooftop solar is also accelerating across the nation and generates almost two-thirds of the electricity as utility-sized solar projects.⁵⁴

China has been the largest developer of coal-fired plants, but has cancelled the development of 103 of them in the past couple years.⁵⁵ China has overdeveloped its energy system, and so even with an increasing coal-fired power capacity, coal use has decreased since 2013. Nonetheless, China already consumes about four times more coal than the United States.

Japan, however, has plans to build 45 additional coal-fired power plants.⁵⁶ These are advanced coal plants with lower greenhouse gas emissions than conventional plants. They will replace old coal plants, some of the expensive oil power they are currently using, and replace some nuclear capacity. Japan's coal primarily comes from Australia. India and many other countries are also continuing to expand their coal-fueled power profiles.

Coal Plants in Utah

Coal-fueled plants have closed and are scheduled to close in Utah. The EPA, under its 2011 Mercury and Air Toxic Standards, requires that coal plants use maximum achievable control technologies. This cost is responsible for some plant closures in the United States, including the Carbon power plant in Utah. That was a modest 172-megawatt plant at the mouth of Price Canyon built in the 1950s. The plant closed one day before the 2011 EPA rule took effect in 2015.⁵⁷

The Intermountain Generating Station coal-fueled operations may be discontinued or scaled back by 2025. In 1977, the Utah Legislature amended Utah Code to allow municipalities to jointly develop power plants in the state. As a result, 23 cities and towns formed the Intermountain Power Agency (IPA). The Millard County site was approved in 1979. IPA acquired water rights from five Millard County irrigation companies the next year, and the year after that the project broke ground. The first generating unit came online in 1985.⁵⁸ While these units could operate for years to come, the major purchasers of the electricity – six large southern California municipalities – are required to cease the purchase of coal energy when existing power purchase agreements expire. Accordingly, IPA plans to bring two natural gas turbines online in 2025.

The Bonanza plant on the Uintah and Ouray Reservation land in the Uintah Basin was built in 1986. It has agreed to new limits on the amount of coal it can burn, “potentially ending its operations by 2030.”⁵⁹ The deal has capped Bonanza's total use of coal at 20 million tons after 2020, unless it installs top-shelf technology known as selective catalytic reduction to control emissions by 2030. Like the Carbon plant, the cost of these controls may lead to the plant's closure.

CONCLUSION

This report is presented in three parts. Part I examined coal-fueled electricity, coal consumption, and production. Part II looks more closely at coal jobs and the economic impacts of coal on the state. It examines Utah's coal mines and the jobs related to those mines at the state's coal power plants. Part III provides insight into the communities that are most affected by changes in coal-related employment. It examines federal, state, local, and community supports in place for Utah's counties that rely most heavily on coal production and coal-fired electricity generation.

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