COLSTRIP

Contents

This appendix describes the Colstrip generating plant, its ownership structure, governance agreements and the history of the site. It explains plant operations and describes the measures the plant employs to minimize environmental impacts. Finally, it summarizes the rules and regulations that may impact the plant's future operation.[1]

For discussion of the Colstrip sensitivities modeled in the 2015 IRP, see Chapter 6, Electric Analysis and Appendix N.

1 / *Potential future CO_2 regulation is incorporated in the overall scenarios for the IRP since it impacts all thermal resources. Since Colstrip is included among these, CO_2 is not treated separately here.*

FACILITY DESCRIPTION

The Colstrip generating plant supplies PSE customers with reliable, low-cost electric power. It also contributes diversity to the electric resource portfolio. Currently the facility supplies 18 to 20 percent of the energy needed to serve PSE's energy needs on an annual basis. The plant consists of four coal-fired steam electric plant units located in eastern Montana about 120 miles southeast of Billings. It was built in two phases.

- Units 1 & 2 began operation in 1975 and 1976, respectively. Each produces up to 307 megawatts (MW) net. PSE and Talen Energy (formerly PPL Montana) each own a 50 percent undivided interest in both units.
- Units 3 & 4 began operation in 1984 and 1986, respectively. Each produces up to 740 MW net. Six companies participate in the ownership of Units 3 & 4. PSE owns 25 percent each of Units 3 & 4, Portland General Electric (PGE) owns 20 percent of both units, Avista owns 15 percent of both units and PacifiCorp owns 10 percent of both. Talen Energy owns 30 percent of Unit 3 and NorthWestern Energy owns 30 percent of Unit 4.

Figure K-1 summarizes ownership of the Colstrip plant.

Figure K-1: Colstrip Ownership Share by Unit and Owner

Owner		Unit 1	Unit 2	Unit 3	Unit 4	Ownership Total, MW	% of Total Plant
Puget Sound Energy	% MW	50% 153.5	50% 153.5	25% 185	25% 185	677	32.3%
Talen Energy		50% 153.5	50% 153.5	30% 222		529	25.3%
NorthWestern Energy					30% 222	222	10.6%
PGE				20% 148	20% 148	296	14.1%
Avista				15% 111	15% 111	222	10.6%
PacifiCorp				10% 74	10% 74	148	7.1%
Total		307	307	740	740	2094	100.0%

The Colstrip Transmission System was built at the same time as Units 3 & 4. This transmission system consists of two single-circuit 500 kV transmission lines that run from the plant to an interconnection with the Bonneville Power Administration (BPA) in Townsend, Montana. It is owned by the five regulated utility owners of the power plant: PSE, NorthWestern Energy, PGE, Avista and PacifiCorp.

Governance

Colstrip owners are governed by two ownership agreements. The Units 1 & 2 Construction and Ownership Agreement executed in 1971 and the Colstrip Units 3 & 4 Ownership and Operations Agreement executed in 1981. There is a separate Operating Agreement for Units 1 & 2.

Each agreement establishes an Owners Committee to guide operating decisions, and the agreements set forth several key conditions.

- Ownership is as "tenants in common," without a right of partition, and the obligations of each owner are several and not joint.
- Assignment and ownership transfer to third parties is limited, with a right of first refusal for an existing owner to acquire any ownership offered for sale.
- The term of the agreements continues for as long as the units are used and useful or to the end of the period permitted by law.
- Each owner must provide enough fuel to operate its share of the units at minimum load.
- Failing to pay its share of project costs or failing to provide adequate fuel constitutes a default on the part of the owner.
- An owner must continue to pay its share of operating costs and coal costs until it has transferred its ownership to another entity.
- No single owner has the ability or right to shut down the plant, so to shut down and decommission any unit all owners of that unit must unanimously agree.
- The ownership contracts do not establish a "put" right for any owner.

The Operating and Ownership Agreement for Units 3 & 4 specifies a voting structure to be used by the Owners Committee for approving annual budgets and other operating decisions. Both ownership agreements provide that the Owners Committee may not amend the agreement. A separate agreement governs ownership and operation of the Colstrip Transmission System.

Requirements after Operations Cease

Potential Plant Remediation Obligations. The Ownership Agreements for both Units 1 & 2 and Units 3 & 4 are silent about a definite date for shutdown of the units. They address decommissioning or remediation costs only to the extent that costs remaining after equipment salvage are to be distributed based on ownership share. Currently there are no plans for decommissioning of the facility.

Potential Mine Reclamation and Obligations. Mining permits held by Western Energy Company (WECo), the coal supplier, require development of reclamation plans and cost estimates for all areas disturbed by mining, and WECo has provided surety bonds to the State of Montana to ensure that reclamation will occur. Plant owners reimburse WECo for the cost of mine reclamation, including final reclamation work after coal deliveries cease, as part of the current costs paid for each ton of coal supplied.

Wastewater Remediation. In August 2012, Talen Energy and the Montana Department of Environmental Quality (MDEQ) signed an Administrative Order of Consent Regarding Impacts from Wastewater Facilities (AOC). The AOC sets up a comprehensive program for investigation, interim response and remediation of any wastewater seepage or spills, and closure of the holding ponds. The AOC provides for preparation of a Site Report for any identified area of the plant site where seepage or spills have occurred. A Site Report must include a description of investigations performed to date in that area, results of modeling, details of pond construction and recommendations for additional characterization. After the Site Report is complete for a given area, a Site Characterization Work Plan, a Cleanup Criteria and Risk Assessment, a Remedy Evaluation Report and, if required, a Final Remediation Action Report will be completed and approved by the MDEQ. The AOC provides for public notice and comment on each report and response by MDEQ to substantive comments. Separately a plan for closure of the wastewater ponds must be prepared and submitted by August 2017. This plan will include requirements for wastewater pond closure which must be completed when operations cease.

Coal Combustion Residuals (CCR) Pond Closure and Related Remediation. On April 17, 2015, the United States Environmental Protection Agency (EPA) published a final rule, effective October 19, 2015, that regulates Coal Combustion Residuals (CCRs) under the Resource Conservation and Recovery Act, Subtitle D. This rule requires significant changes to the Colstrip operations and post-closure requirements. The changes were reviewed by PSE and the plant operator in the second quarter of 2015. Refer to the section below titled "Rules and Proposed Rules" for additional information regarding CCR.

The History of Colstrip

The Northern Pacific Railway established the town of Colstrip in 1924 at the northern end of the Powder River Basin to provide coal for its steam locomotives. The Powder River Basin is the single largest source of coal in the United States and is one of the largest deposits of coal in the world. At Colstrip, coal is mined from the Rosebud seam of the Fort Union Formation. The railroad shut down the mine in 1958 when it switched to diesel locomotives, and the Montana Power Company purchased the rights to the mine and the town in 1959. They resumed mining operations in the 1970s with plans to build coal-fired electrical plants.

In the 1960s, BPA forecast that available baseload hydroelectric power would be fully subscribed by its statutory preference customers, leaving none available for sale to PSE and other investor-owned utilities. Faced with this situation, PSE had to develop or contract for other sources of baseload energy. Developing a coal-fired generating plant at Colstrip, Montana was the result. The adjacent Rosebud mine offered plentiful coal reserves that could be delivered to the generating plant without the need for costly rail facilities. Sharing the ownership and output of a two-unit plant with Montana Power Company (whose generating plants were later acquired by Talen Energy) made construction and operation more economical, and sharing the output of two units increased reliability compared to owning a single unit of similar size or a larger, single-unit plant.

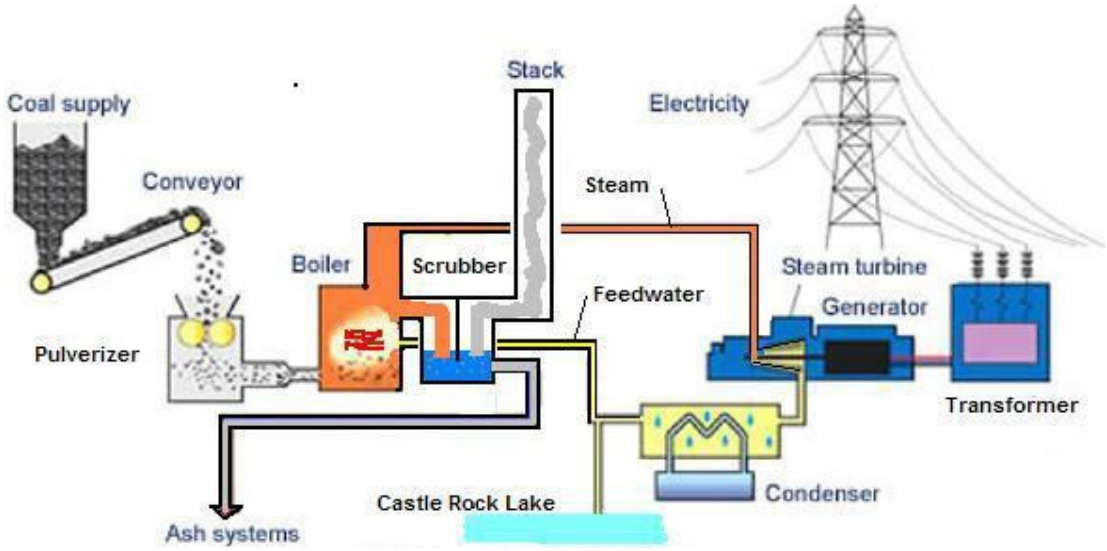
In the early 1970s, under the same forecast that the region's investor-owned utilities would soon lose access to BPA baseload hydro power, PSE and Montana Power Company began planning for Units 3 & 4 together with three other utilities. Construction of the two units began, but delays in obtaining the required Montana Major Facility Siting Act Certificate postponed their opening until 1984 and 1986 respectively. The 500 kV Colstrip Transmission System was constructed in tandem with Units 3 & 4.

The power plant and mine dominate the economies of Colstrip and Rosebud County, although ranching is also an important source of jobs and income. A 2010 study by University of Montana economists estimated that the plant and mine support more than 3,700 jobs, $360 million of personal income and over $100 million of annual tax payments to the State of Montana and county and local governments.

Plant Operations

Each of Colstrip Units 1 & 2 consists of a fuel supply system, a coal-fired boiler, a steam turbine-generator, a cooling tower, step-up transformers, piping, and electric distribution and auxiliary equipment. Figure K-2 provides a simplified illustration of how each of Colstrip Units 1 & 2 generates electricity.

Figure K-2: Colstrip Plant Operations Diagram



How Colstrip Generates Electricity. Coal from the Rosebud Mine is crushed into 3-inch chunks and transported to the generating plant on overland conveyors or in trucks where it is stored in piles at the plant site before being moved to silos in the boiler buildings. Coal travels through a pulverizer that grinds it to the consistency of talcum powder. The pulverized coal is then mixed with air and blown into the boiler. Inside the boiler, the coal and air mixture burns, releasing hot gases that convert water in boiler tubes to steam. The steam powers turbines connected to electric generators, which transform the mechanical energy from the turbine into electric energy.

Afterwards, the hot gases are drawn into the scrubbers, where they are cleaned before being exhausted through the stack. Bottom ash, the heavier of the two residuals, sinks to the bottom of the boiler where it is collected for treatment and storage. The lighter fly ash is pulled into the scrubbers with the flue gases, where it is captured for treatment and storage. The scrubbers also capture sulfur and mercury emitted from the coal during combustion.

Water for plant operations comes from the Yellowstone River. A 30-day supply is maintained in Castle Rock Lake, a man-made lake constructed as part of the plant facilities. As water enters the plant it is divided into two streams. The largest flows to the cooling towers where it replaces water lost from evaporation, the smaller flow is used for various processes including equipment cooling and scrubber system make-up. Water used in the boilers is demineralized before entering a closed-loop system that passes through the boiler and turbine system.

Environmental Impact Measures. Nearly every step of the process includes measures to reduce environmental impacts.

NO_X. Coal and air leaving the pulverizers passes though burner systems and over-fire air systems that cool the flame temperature and reduce the formation of nitrogen oxides (NO_X). Units 1 & 2 use a second-generation low-NO_X combustion system with a close-coupled over-fire air injection. The newer Units 3 & 4 use a third-generation combustion system with separated over-fire air injection. Digital control systems recently installed on all four units further enhance NO_X emissions control.

MERCURY. Coal contains mercury. To oxidize the mercury and enhance its capture, the coal is treated with a bromine solution before entering the boiler. Then, flue gases are treated with powdered activated carbon to capture the mercury before the gases enter the scrubbers; there, the activated carbon and mercury are removed along with other particulate matter.

SO_2. Permit specifications limit the amount of sulfur in the coal fuel. Additionally, all four units remove sulfur dioxide from flue gases using wet alkali scrubbers. These scrubbers use the alkalinity of fly ash and/or hydrated lime to capture SO_2; then a water spray collects the fly ash and the mercury for further processing.

COAL COMBUSTION RESIDUALS (CCR). Two types of ash are produced by coal combustion. Bottom ash makes up 30 percent to 35 percent of the total. Fly ash makes up the remainder. The larger and heavier bottom ash falls into a water-filled trough in the bottom of the boiler; from there it is pumped to settling ponds on the plant site and then to permanent storage ponds. Some bottom ash is used as a construction material.

The smaller and lighter fly ash and other particulate matter (PM) passes into the scrubbers with the flue gases. The scrubbers use the fly ash's alkalinity and/or hydrated lime to capture SO_2 gases, and a water spray removes the fly ash and other PM. The resulting scrubber slurry is piped to storage ponds. Before final placement in the storage "ponds," paste plants remove most of the water; the paste, which begins the process at about 65 percent solids, sets up like low-grade concrete after several days.

The original ash holding ponds at Colstrip were designed with highly impermeable clay liners to prevent slurry components from seeping into the groundwater. These conformed to the requirements of the Montana Major Facility Siting Act Certificate. Monitoring wells, installed prior to the start of operations, monitor the groundwater for any sign of possible contamination (pond water seepage), and capture wells pump impacted ground water back to the ponds.

Since 2000, projects have been completed to control ash pond leakage, reduce migration of affected groundwater and to upgrade plant wastewater systems to allow increased recycling of water.

History of Ash Holding Pond Seepage. Several years after the first slurry was placed into the stage one pond for Units 1 & 2 some of the monitoring wells began to show increases in groundwater constituents, such as dissolved salts, which could indicate that some of the ash constituents were migrating through the clay lining. In consultation with MDEQ (the Montana Department of Environmental Quality), Colstrip plant operators installed capture wells to capture affected groundwater and pump it back to the ponds to prevent affected water from leaving plant property, as well as additional monitoring wells. In addition to capture wells, existing ponds have been continually modified and additional storage cells have been installed over time utilizing newer, state-of-the-art lining methods including polymer liners, geo membranes and leak detection/collection systems.

In the late 1990s, pond seepage was identified off plant property for the first time in a shallow groundwater well at the Colstrip Moose Lodge. The MDEQ was notified, a meeting was held with residents and businesses near the Moose Lodge to discuss the issue, and the plant provided a replacement well at a much greater depth.

In 2003, a group of Colstrip residents filed suit against the Colstrip owners claiming (1) homes had been damaged by settlement caused by the filling of Castle Rock Lake[2] and (2) that leakage from a Unit 1 & 2 ash pond had impacted shallow groundwater under private property. This lawsuit was settled, and although no impact to drinking water wells was identified, the plant connected the property owners with the municipal water supply as a precaution.

In 2007, two ranch owners filed a second lawsuit alleging groundwater contamination from the Units 3 & 4 effluent holding ponds. That lawsuit was also settled.

2 / Due to naturally occurring ash deposits, some of the soil in the area is susceptible to collapse when initially saturated with groundwater, such as when Castle Lake was filled to serve as the facility's water reservoir and town's drinking water supply. These 2003 claims were repeat claims of earlier lawsuits in the 1990s that also addressed construction methods (although the collapse potential was known, it was alleged that houses were not constructed with appropriate foundations, etc.).

RULES AND PROPOSED RULES

During the next five years, the Colstrip units will become subject to several recently enacted regulations, changes in existing regulations and a rule governing coal combustion residuals (CCR) published in December 2014. CCR includes fly ash, bottom ash and scrubber slurry from Colstrip.

Mercury and Air Toxics (MATS) Rule

The EPA published the final Mercury and Air Toxics Standard in February 2012 to reduce air pollution from coal and oil-fired power plants with a capacity equal to or greater than 25 megawatts. The MATS rule establishes emissions limitations at coal-fired power plants for mercury (1.2 lbs per trillion British thermal units, and for acid gases and certain toxic heavy metals using a particulate matter surrogate (0.03 lb per million British thermal units (MMBtu)). Coal-fired generating units had until April 2015 to comply with MATS, and they could receive up to a 1-year extension from state permitting authorities for the installation of controls if necessary.

On June 29, 2015, the United States Supreme Court held that the EPA failed to consider costs when deciding whether it was “appropriate and necessary” to regulate emissions of mercury and other hazardous air pollutants from power plants. The Supreme Court’s decision overturned a 2014 ruling by the U.S. Court of Appeals for the District of Columbia Circuit (“D.C. Circuit”), which held that EPA’s decision not to consider costs in the initial stages of the MATS rulemaking process was reasonable. The Supreme Court remanded the decision on MATS back to the D.C. Circuit for further proceedings, so the full impact is not yet known.

The D.C. Circuit can either remand or vacate EPA’s decision. Under a remand the MATS rule would remain in effect while EPA addresses the deficiencies outlined by the Supreme Court. If the court vacated the rule, EPA would have to start the entire rulemaking process over again. EPA and environmental groups have already signaled their intent to argue for remand. The D.C. Circuit’s decision is not expected for at least ten months, though industry petitioners may request expedited consideration.

Assuming the rule remains in effect while EPA addresses the deficiencies; plant compliance is required by April 2016. The mercury control system installed at Colstrip to meet a previous Montana mercury rule will also meet the MATS requirements for mercury capture and removal. The existing scrubbers on all four units adequately remove acid gases covered by the rule.

Some investments for additional PM control by the Unit 1 & 2 scrubbers are required to comply with the heavy metals requirements of the MATS Rule. Installation of this additional equipment (sieve trays) on Units 1 & 2 scrubbers began in the second quarter of 2014; it continued in the second quarter of 2015 and will be completed in the second quarter of 2016. Completion of this project will ensure the plant is compliant with the PM requirements of the MATS Rule. The Unit 3 & 4 scrubbers already remove the required level of PM.

See http://www.epa.gov/mats/actions.html for more information on the MATS Rule.

The Regional Haze Rule

Adopted in 1998, the Regional Haze program is a 64-year program administered by the U.S. EPA under federal law to improve visibility. Specifically the rule is aimed at improving visibility in mandatory Class I areas (National Parks, National Forests and Wilderness Areas) and is not a health-based rule. The rule requires each state to prepare an analysis of visibility impairments to Class I areas and develop plans to eliminate man-made impairment by 2064. Major sources that began construction before 1977 (including Colstrip Units 1 & 2) must bring emission controls to Best Available Retrofit Technology (BART) standards during the initial review cycle. “Reasonable Progress” requirements call for an updated analysis of impacts every five years. It requires states to constantly decrease haze in certain scenic areas of the country over time according to a “Glide Path.” Power plant emissions contributing to haze are evaluated in phases every 10 years and more stringent emission controls are required as needed to stay below the Glide Path.

The EPA published its Final Implementation Plan (FIP) for Colstrip, covering both the BART and Reasonable Progress requirements in September 2012 with implementation required within five years. The first phase of the Regional Haze program set emission limits for Colstrip 1 & 2 based on various emissions control technologies to bring the haze level below the Glide Path.

There were no immediate requirements for Colstrip Units 3 & 4, but Colstrip Units 1 & 2 were determined by EPA to need to upgrade pollution controls to meet new sulfur dioxide and nitrogen oxide limits. The Sierra Club filed an appeal of the FIP with the United States Court of Appeals for the Ninth Circuit on November 15, 2012, and Talen Energy also filed an appeal as the Colstrip operator.

The case was heard on May 15, 2014 in Seattle, Washington, and the final decision by the Ninth Circuit was issued June 9, 2015. The 9th Circuit Court of Appeals reviewed EPA's first phase requirements for Colstrip and found that the EPA had not adequately justified the need for two of the control technologies and remanded these two issues back to EPA for re-do.

The ruling in no way affects the future planning periods for the Regional Haze program or the Glide Path. The current EPA assessment is that the state of Montana will require significant emission reductions to meet the natural visibility goal by 2064 which means that additional emission reductions will be necessary in future 10-year planning periods, beginning in the 2018-2028 period, and there is risk and uncertainty regarding potential costs.

For more information on the EPA FIP, see http://www2.epa.gov/sites/production/files/2014-02/documents/epafinalactononmontanaregionahazeplan.pdf.

For the draft Federal Implementation Plan containing EPA's analyses and cost estimates, see https://federalregister.gov/a/2012-8367.

Coal Combustion Residuals Rule

On April 17, 2015, the EPA published a final rule, effective October 19, 2015, that regulates coal combustion residuals (CCRs) under the Resource Conservation and Recovery Act, Subtitle D. The CCR rule addresses the risks from coal ash disposal, such as leaking of contaminants into ground water, blowing of contaminants into the air as dust, and the catastrophic failure of coal ash containment structures by establishing technical design, operation and maintenance, closure and post-closure care requirements for CCR landfills and surface impoundments, and corrective action requirements for any related leakage. The rule also sets out recordkeeping and reporting requirements including posting specific information related to CCR surface impoundments and landfills to a publicly-accessible websites. Using information from these public websites, enforcement of the CCR rule is left entirely to citizens' lawsuits – not EPA.

See http://www2.epa.gov/coalash/coal-ash-rule, and
http://www.gpo.gov/fdsys/pkg/FR-2015-04-17/pdf/2015-00257.pdf

Clean Water Act

Cooling water intake and discharge. The EPA finalized the changes to Section 316(b) of the Clean Water Act that apply to power plant standards in May 2014. The rule requires power plants to install any one of a variety of technologies to reduce the amount of fish and other aquatic life killed by cooling water intake pipes. Environmental groups filed three separate challenges to the rule on September 2, 2014. They contend that the EPA gave utilities too much flexibility in finding a way to comply. On September 4, 2014, Entergy Corporation and the Utility Water Act Group, a coalition of 191 energy companies and three utility trade associations, filed a joint challenge on behalf of utility companies. This lawsuit is still pending before the Fourth Circuit Court of Appeals.

The rule's requirements address these potential impacts:

- Existing facilities with a design intake flow of greater than 2 million gallons per day, where more than 25 percent is used for cooling, are required to select from 9 compliance options related to impingement mortality.
- Existing facilities that withdraw at least 125 million gallons per day are required to monitor entrainment and assess the costs, benefits and other adverse environmental impacts of measures for reducing entrainment mortality. Based on these reports, the regulatory agency selects the best technology available for reducing entrainment mortality at a facility.
- New units that add electrical generation capacity at an existing facility are required to install technologies that reduce impingement and entrainment to a level equivalent to closed-cycle cooling.

Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category. On September 30, 2015, the EPA finalized a rule to regulate wastewater discharges from power plants. The new rule sets limits on dissolved pollutants permitted in these discharges, and focus on mercury, selenium, and arsenic (toxic metals previously unregulated in this context).

The finalized rule applies to all steam electric power plants, except for those smaller than 50 megawatts in production capacity, and oil-fired plants. Out of approximately 1,080 steam electric power plants in the U.S., 134 are expected to require new investments in order to comply with the regulations. The regulations will take effect in 2018, and compliance will be phased in through 2023.

Along with effluent limits on toxic metals and dissolved solids, the rule establishes zero discharge limits on pollutants in ash transport water and flue gas mercury control wastewater. Many units in the Pacific Northwest will be compliant with the rule provisions with their current controls, and therefore will not incur additional compliance costs. Colstrip is a Zero Liquid Discharge (ZLD) facility, so it will not be affected by the rule.

The Clean Air Act

National Ambient Air Quality Standards (NAAQS). Two types of national air quality standards are established by the Clean Air Act. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation and buildings. These ambient level standards apply uniformly throughout the states. The Clean Air Act required EPA to set NAAQS for widespread pollutants from numerous and diverse sources considered harmful to public health and the environment. EPA has set NAAQS for six "criteria" pollutants; periodic review of the standards and the science on which they are based is required. Each time the NAAQS are revised, the states must evaluate whether any parts of the state exceed the standard (these are “non-attainment” areas). If a state contains any non-attainment areas, it must propose a plan and schedule to reduce emissions in order to achieve attainment approval by the EPA. Currently the Colstrip area of Montana is in attainment for all criteria pollutants. Reductions in Colstrip emissions for SO_2, NO_X and PM to meet the MATS Rule and the EPA FIP are expected to keep the area in attainment with any NAAQS revisions with no further actions required. For more information, go to http://www.epa.gov/ttn/naaqs/criteria.html.

Section 111(d) of the Clean Air Act. EPA issued a final 111(d) rule on August 3, 2015 which included several changes, many of which were requested in PSE’s comments. Specifically, EPA excluded energy efficiency from the building blocks, leaving just three building blocks (increased efficiency for coal plants, greater utilization of natural gas plants and increased renewable sources), and provided more flexibility on interim goals by phasing in the reduction of the second building block and giving states the option to set their own interim compliance glide path and pushing the start of compliance to 2022. EPA also adjusted the 2012 baseline to address hydroelectricity variability and provided specific CO_2 mass targets by year for each state.

States have broad flexibility to pick a rate-based or mass-based approach and can design compliance options and decide how to allocate credits and whether to allow trading.

EPA also gave states the option of seeking an additional time if necessary to formulate a state plan---states must submit something within one year but can request up to an additional two years for development of a state plan.

Based on the changes to the final rule, the final CO_2 goal for Montana became 26 percent more stringent and the final CO_2 goal for Washington became 35 percent less stringent. By 2030 Montana must reduce CO_2 emissions from coal plants from 20.5 million tons of CO_2 to 11.3 million tons of CO_2 which is a 45 percent reduction in CO2 emissions. How this will affect Colstrip cannot be determined until a state implementation plan for Montana is finalized and approved by EPA.