# Analysis of the Tongue River Railroad Draft Environmental Impact Statement

**Prepared for Sierra Club and Earthjustice**

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# CONTENTS

# 1. EXECUTIVE SUMMARY

The Tongue River Railroad Company (TRRC) has issued a proposal to construct and operate a 42-mile rail line in the Powder River to transport coal from mines that could be developed at several sites in Montana, collectively referred to as "Tongue River coal". The Surface Transportation Board's (STB) Office of Environmental Analysis (OEA) conducted an analysis to assess the potential economic and environmental impacts of the construction and operation of the Tongue River Railroad on coal production, coal markets, and rail transportation.

STB did not provide access to IPM model input and output files, nor as to technical model documentation, thus severely limiting our ability to do a complete and thorough review of the DEIS analysis. STB's analysis hinges on things that occur on the margin, whether that is with respect to coal production or electric sector dispatch. STB did not document whether or not it considered if the presence of Tongue River coal might:

1. Lead to variation in the delivered prices of coal;
2. Cause existing coal plants to increase their production of electricity, and thus lead to increased greenhouse gas emissions; and
3. Delay the expected retirements of certain existing coal plants.

Without the necessary data, we cannot perform an analysis of the extent to which the presence of Tongue River coal might lead to any or all of those outcomes. For these reasons, we recommend that agency officials and the public view the IPM modeling analysis and the conclusions of the DEIS with skepticism.

We can, however, make the following criticisms of the DEIS analysis:

1. STB minimizes the greenhouse gas emissions associated with the Tongue River Railroad and associated coalmines by looking at a 20-year analysis period rather than over the 55-year expected life of the mines;
2. The agency omitted certain reasonable scenarios, i.e. a high natural gas price sensitivity, that would result in greater emissions of greenhouse gases.
3. It seems likely that Tongue River coal will be exported for international use rather than for domestic use from the information contained in the DEIS. By STB's own analysis, the scenarios with higher volumes of exported coal have much higher volumes of greenhouse gas emissions.

Lack of the necessary data, as well as criticisms outlined above undermine STB's conclusions that the greenhouse gas impacts of the Tongue River railroad and associated coalmines would be negligible.

# 2. INTRODUCTION

The Tongue River Railroad Company (TRRC) proposes to construct and operate a 42-mile rail line in the Powder River Basin between Coalstrip, Montana and the Ashland and Otter Creek areas of Montana. The rail line would transport low-sulfur, bituminous coal from mine sites that could be developed in Rosebud and Powder River Counties in Montana, which includes the proposed Otter Creek Mine (collectively referred to as "Tongue River coal") which would introduce more than one billion tons of new coal into the market over the 55-year life of the mine. To assess the potential economic and environmental impacts of the construction and operation of the Tongue River Railroad on coal production, coal markets, and rail transportation, the Surface Transportation Board's (STB) Office of Environmental Analysis (OEA) conducted an analysis and summarized its findings in a Draft Environmental Impact Statement (DEIS). OEA's analysis examined 21 scenarios and came to the following conclusions:

- Tongue River coal production could induce coal mining.[1] Production in the new mines would range between 20 million and 72 million tons per year, depending on the scenario.[2]
- For each ton of Tongue River Coal produced, production of other Powder River Basin coal would decline by 0.76 tons on average, and production of total U.S. non-Tongue River coal would decline by 0.95 tons on average,[3] thus leading to small increases in overall coal production and resulting greenhouse gas emissions.[4]
- Production of coal from Tongue River would not affect the amount of Powder River Basin coal exported to the countries in the Pacific Basin (i.e., Japan, China, South Korea, Thailand, Singapore, and the Philippines);[5] however, if any or all of the proposed coal terminals in the United States and Canada are built or expanded, there would likely be increases in coal production and transport from the Powder River Basin, regardless of the existence of Tongue River. These increases could be small or large.[6]

In order to arrive at these conclusions, OEA: 1) analyzed production costs for Tongue River coal; 2) conducted a resource analysis of Tongue River coal, examining factors such as stripping ratio,[7]

[1] DEIS Appendix C, page C.1-1

[2] DEIS Appendix C, page C.7-9

[3] DEIS Appendix C, page C.8-6

[4] DEIS Appendix C, page C.1-2

[5] DEIS Appendix C, page C.1-1

[6] DEIS Appendix C, page C.1-2

[7] The stripping ratio refers to the ratio of coal to waste material (known as "overburden") that is extracted during mining. For example, a 4:1 stripping ratio means that mining one cubic meter of coal would require also mining four cubic meters of waste rock. Surface mining tends to have higher stripping ratios due to the fact that overburden must be removed prior to coal extraction. This may also be referred to as the overburden ratio.

production quantity, distance to railroad, and ability to obtain mining rights in order to assess economic competitiveness; and 3) used ICF International's Integrated Planning Model (IPM) to simulate operations in the U.S. electric sector, and capture interactions between coal from Tongue River and the domestic and international coal markets.[8] This report examines STB's use of the IPM model, the input assumptions, the output results, and the agency's conclusions.[9]

Section 3 describes general economic principles that are applicable to the Tongue River Analysis. The remainder of this report examines and critiques the input assumptions used by STB, to the extent possible. The lack of detail provided in the DEIS on the assumptions, data inputs, and methodologies used by STB in its analysis prohibits adequate third-party review of the study. Several requests for IPM model input and output files were made, and while we received certain input and output variables, we did not receive the model files that were requested. The reasons that these files are necessary for an adequate review are described in Section 4, and our correspondence is documented. Section 5 critiques STB's conclusion that Tongue River coal would primarily be used domestically, and instead describes the evidence that supports the conclusion that the coal from these mines would be more likely to be exported. By STB's own analysis, the export scenarios show much larger volumes of $CO_2$ emissions, and do not support STB's conclusion that the greenhouse gas effects of the Tongue River Railroad are minor.

# 3. GENERAL ECONOMIC PRINCIPLES APPLICABLE TO THE TONGUE RIVER ANALYSIS

In general terms, a new source of coal that has a less expensive delivered price[10] than some other coals currently being purchased should "shift the supply curve" for coal. This means that the total amount of coal that can be purchased for less than any given price will increase relative to a scenario without the new source of coal.

It would be reasonable to expect that, in this event, more coal will be purchased in total by coal plants if a new and cheaper source of coal were to enter the market, especially among the coal sources that are "on the margin" (the coal sources with the highest delivered prices that are currently being purchased); and either (or both):

[8] DEIS Appendix C, page C.1-6

[9] Synapse did not attempt to independently verify production costs for the Tongue River coal, nor did we do a resource analysis, and this report does not address the economic viability of the Tongue River Railroad or the associated coal mines. The focus of this report is the IPM modeling used to support STB's conclusions. Accordingly, this report assumes that the railroad and coalmines would be constructed in order to evaluate the likely market and climate impacts, but it does not endorse the STB's conclusions on the economic viability of the proposals.

[10] Typically, the delivered price of coal is the sum of the minemouth price plus the cost of transportation.

1. Some existing coal plants increase their production of electricity, which requires that there is variation in power plants bids into the wholesale electric market, especially among electric sources that are on the margin. In a wholesale electric market, power plants are dispatched based on their bids, which typically represent the variable operating cost of the power plant. A large portion of this variable cost is fuel cost. Plants that are on the margin are those plants with the highest bid (and thus the highest variable cost) needed to meet load in a given hour. To the extent that a new and cheaper source of fuel enters the market, it may lower the operating costs, and thus the bid prices, of some existing coal plants. These plants may be called upon to generate more electricity, displacing certain other higher-priced generators on the margin.

2. Some existing coal plants postpone their retirements based on their expected purchase of less expensive coal.

If more coal is purchased and used, there are more $CO_2$ emissions from coal combustion, and more $CO_2$ from the electric generating sector as a whole. STB's analysis does show small increases to total coal generation and total coal emissions in scenarios in which Tongue River coal enters the market, but the agency's modeling results are consistent with a coal market in which there is little variation in the delivered price of coal within a region. That is, if STB were assuming more variation in the price of delivered coal, we would expect a greater increase to coal generation and coal emissions compared to scenarios without Tongue River coal. The information provided to us by STB regarding coal prices did not include supply curves[11] or delivered prices for coal and is, therefore, not appropriate to allow the kind of meaningful third-party review expected in a public process. When asked directly for the files that would allow us to analyze this variation at the margin, STB declined to provide them.

By STB's own analysis, the "total U.S. coal $CO_2$ emissions from the incremental consumption of Tongue River coal averaged over 2018 to 2037 would range from an increase of 0.4 to 6.4 million metric tons per year and would average an increase of 2.4 million metric tons of $CO_2$ per year."[12] (Note this is just for the domestic part of STB's analysis. The international portion of the analysis is discussed in Section 5.) Under EPA's recently finalized Clean Power Plan, which regulates $CO_2$ emissions from existing electric generators with a goal of cutting $CO_2$ emissions from the electric sector by 32 percent by 2030, any increase is too much and is inconsistent with the emission reduction targets the rule is designed and modelled to achieve. While the Clean Power Plan rule is mentioned in the DEIS, the STB did not include the emission reduction goals in its analysis of the environmental impacts of the Tongue River Railroad.

[11] While STB did provide what it defined as "coal supply curves," this data only includes annual coal capacity, price, and coal resources available for four areas of the Powder River Basin. It does not include the delivered costs for coal, nor does it contain information for any other coal mines in the United States, as "the remaining coal supply curve data is data that is proprietary to ICF." Email communication from Danielle Gosselin on August 31, 2015. It is thus impossible to construct a true supply curve for coal as projected by STB.

[12] DEIS Appendix C, page C.10-9

# 4. TRANSPARENCY IN THE EIS PROCESS

Synapse's review of the DEIS report and the associated IPM analysis found them to be largely inauditable, meaning that they lack the transparency and verifiable data necessary for independent review, and thus do not provide the useful, objective tools necessary to inform a public decision-making process meant to ensure the public good. Our review of STB's analysis found that the agency produced a report using data that are not publicly available and therefore not auditable without the release of additional information. That is, the lack of detail on the assumptions, data inputs, and methodologies used by STB in its analysis greatly impedes adequate third-party review of the study. Analyses that are included in a productive public discourse should be defensible and have well-defined methodology and assumptions, combined with the use of publicly available information. For these reasons, we recommend that agency officials and the public view the IPM modeling analysis and the conclusions of the DEIS with skepticism, at least up to and until the STB makes all of the assumptions, data inputs, and methodologies available to the public for review and comment as part of a supplemental DEIS. That type of wholly transparent analysis is necessary before it can be determined that the development of the Tongue River Railroad and the associated coal mines will not result in significant environmental impacts.

The following sections describe the IPM model and the obstacles we encountered in our attempt to review the input assumptions used by STB and the output results of the agency's analysis of Tongue River.

## 4.1. Obstacles to the Public Review Process

Due to proprietary nature of the IPM, CoalDOM and GMM models, they not available for license to users outside of ICF. While there may be exceptions, generally any party that would like to analyze scenarios using IPM must contract with ICF to do the modeling. We were able to identify specific overt weaknesses in the STB's analysis, but unless the model input and output files and user documentation is made available, it is impossible for anyone attempting to evaluate the IPM methodology and results—including those that contract ICF to run its model, such as the STB here—to have a full understanding of the input assumptions, calculations, and output results used in a particular analysis. Government agencies engaged in IPM modeling will at times provide these files to intervenors or the public for analysis. For example, the U.S. Environmental Protection Agency (EPA) secures the IPM files and model documentation for its proposed and final rulemakings related to clean air policies and provides those files to the public for review and to use as a reference during the public comment period, most recently for the final Mercury and Air Toxics (MATS) Rule[13] and the final Clean Power Plan Rule.[14]

We made several attempts to obtain the IPM input and output files from STB, as well as the technical model documentation, which provide the basis for the agency's analysis and underlie its conclusions.

[13] See http://www.epa.gov/airmarkets/programs/ipm/toxics.html

[14] See http://www.epa.gov/airmarkets/programs/ipm/cleanpowerplan.html

None of those materials were made available despite our repeated attempts to obtain the necessary information. We asked for the detailed IPM input and output files for the scenario runs,[15] and attempted to make our requests very specific by asking for files with the following formats and/or extensions: the System Summary Report, and anything with a .DAT, .RPE, .CAR, or .TAC file extension.[16] Given the "black box" nature of the IPM model, we had to base our more specific requests on our knowledge of the IPM modeling that has been done for the U.S. EPA, requesting files with the same extensions as those that inform the agency's modeling of environmental rules. In our original request, we also asked for information on specific input and output variables, as well as any work papers or workbooks that ICF used to develop the input assumptions or analyze the output results.

More than a month after our original request, STB sent a CD with certain of the specific input variables for which we had asked[17], which included: energy demand by model region; capital costs for certain new types of generating units; pollution control retrofit options available to existing coal-fired generators; a list of the types of constraints that are used in the IPM model; emission allowance caps that are in place in the model for $SO_2$ and $NO_x$; and data for what STB calls "coal supply curves,"[18] which consists of annual coal capacity, price, and coal resources available for four regions in the Powder River Basin.

The agency also sent certain output variables for which we had asked, which included: coal and natural gas prices; new capacity that was added over the study period, by type, year and scenario; electric generation by fuel type and by year for each scenario; fuel consumption by fuel type and by year for each scenario; and generation, fuel consumption, and emissions by year, region and capacity type for each of the scenarios studied by STB.

The data that were sent by STB was only a small fraction of what is needed to review an analysis of this magnitude. STB's results and conclusions depend on things that happen at the margin. We would need delivered prices for coal in order to construct proper coal supply curves, the variable operating costs for all of the generating units in the U.S., data on wholesale electric prices for each of the time periods modeled in STB's analysis, and the resulting electric generation from each of the generating units in each of the modeled time periods. We would need fuel consumption and resulting emissions by generating unit, by time period. In addition to a list of the types of constraints that are included in IPM, we would need to see how they were applied—in what quantities and in which regions. We would need to understand the model settings—how does the IPM model respond and reflect changes in fuel prices, and fuel supply? This data is voluminous, and the data that we did receive from STB pales in comparison to that which was withheld by the agency. Without that additional data, what we did receive from STB is of little practical use.

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[15] Email request by Rachel Wilson on July 14, 2015.

[16] Email requests by Rachel Wilson on July 30, 2015 and August 4, 2015.

[17] Data CD sent by STB, received by Synapse on August 21, 2015.

[18] We do not consider these data to actually represent coal supply curves, as one would need the delivered costs for coal in order to construct a true supply curve.

After asking again for modeling input and output files, we were informed that the IPM model platform had changed and the file extensions that we had asked for were no longer used or created by IPM.[19] Model input and output files in the new format with the new file extensions were requested, as was a stand-alone technical document for the IPM model.[20] The response from STB was that there are no readily available substitutes for the files to which we referred, that there was no stand-alone technical document, and that while a user's manual for IPM exists, it is proprietary.[21]

Given the limited data availability, despite repeated attempts by us to obtain the necessary files, we must conclude that STB's study of the Tongue River Railroad and the associated coal mines lacks the transparency necessary for third party review and verification. The study does not provide critical data needed to confirm or critique its results, as described above. The IPM input and output files are necessary in order to identify both simply transcription errors that may have a dramatic impact on results, as well as erroneous input assumptions or a misrepresentation of output results. By presenting its conclusions in the DEIS document but refusing to give any of the necessary data or assumptions, STB is essentially providing an answer to an equation and asking us to trust that it is correct without showing any of its work.

The results of STB's domestic analysis hinge on what happens on the margin, both in terms of coal supply and electric sector dispatch. As mentioned in Section 3, the variation in the delivered price of coal from that of those coal mines with the highest delivered prices currently being purchased in the market (those mines that are on the margin)would cause more coal to be purchased and burned (creating more emissions of greenhouse gases) if:

1. Existing coal plants increase their production of electricity, which would require variation in the price bid into the wholesale electric market by participating generating units, especially among those generating units with the highest price bids—those that are on the margin; and/or

2. Some existing coal plants postpone their retirements based on anticipated lower operating costs resulting from the purchase of less expensive coal.

STB failed to document this analysis. Lacking the opportunity to analyze model input and output files, and the ability to review technical documentation, we are unable to do our own analysis at the margin for both coal supply or electric system dispatch, and cannot determine how sensitive the IPM model is to price changes in U.S. coal supply.

STB makes two important conclusions in its analysis: 1) that the production and use of Tongue River coal would displace other Powder River Basin coal production at a ratio of one ton to 0.76 tons and other domestic coal production at a ratio of approximately one ton to 0.95 tons; and 2) that Tongue River coal

[19] Email correspondence from Danielle Gosselin on August 31, 2015.

[20] Email request by Rachel Wilson on September 10, 2015.

[21] Correspondence from Danielle Gosselin on September 11, 2015.

would lead to small increases in overall coal production and resulting greenhouse gas emissions. These conclusions seem contradictory. If Tongue River coal were a perfect substitute for other domestic coal, both in the Powder River Basin and in other parts of the United States, we would expect to see a 1:1 displacement ratio, but the STB's conclusion is that one ton of Tongue River coal only displaces 0.76 tons of Powder River Basin coal, and 0.95 tons of other domestic coal. Emissions must, then, be greater, and STB's assertion that Tongue River Coal will increase neither coal production nor emissions cannot be true.

The IPM model does appear to be sensitive to price changes in coal supply. Without the IPM model files, however, we cannot perform an analysis of electric system dispatch or the production of electricity in STB's 21 scenarios to verify that this is true, or to measure the magnitude of that sensitivity. Perhaps just as importantly, it cannot be verified that ICF performed this analysis either. The information needed to review the STB's methodology on this important factor is not in the DEIS, it is not in Appendix C, and it is not in any of the documents the STB provided after we asked for this specific information. This is especially important given that IPM is not capable of doing a chronological dispatch, instead having a set number of load periods. Because the generating unit that is on the margin can change on an hourly basis, IPM thus cannot accurately represent decisions made by individual generating units about whether or not to generate electricity. In the DEIS and related appendices, the STB failed to document whether it even considered critical factors that are necessary to any economically justifiable examination of this issue, including the extent to which the presence of Tongue River coal might: 1) lead to variation in the delivered prices of coal; 2) cause existing coal plants to increase their production of electricity, and thus lead to increased greenhouse gas emissions; and 3) delay the expected retirements of certain existing coal plants. Without the necessary data, we are unable perform this analysis.

## 4.2. The IPM Model

IPM is an electric simulation model, proprietary to ICF International, which contains both capacity expansion[22] and power plant dispatching[23] capabilities. The model provides a least-cost forecast for a given set of future conditions, seeking to minimize both coal market costs and electric power sector costs. Model outputs include forecasts wholesale market power prices, power plant dispatch, transmission flows, emissions, capacity expansion and retirements, power plant retrofits, and fuel consumption and prices.

[22] Capacity expansion models screen and evaluate supply- and demand-side options to meet future energy needs in response to user-input demand growth in a specific service area or region, making decisions about 1) the type of resource to build; 2) where to build a specific resource; 3) the quantity of that resource to build; 4) the timing of new resource builds.

[23] Power plants are operated, or "dispatched," in order to meet electric demand over the course of a day. The variable operating costs of each generator determine which units in a power system are dispatched first. Plants with the lowest costs tend to be dispatched first, and plants with higher operating costs are dispatched sequentially as electricity demand increases.

Two additional proprietary ICF models feed into the IPM model: 1) the Coal Depletion Optimization Model (CoalDOM) and 2) the ICF International Gas Market Model (GMM). CoalDOM builds supply curves for coal in the 40 U.S. coal supply regions and 25 international supply regions using data on coal reserves and cost of production, and matches them to 178 demand regions in the United States and Canada, and 26 international demand regions. The GMM model conducts a similar exercise for natural gas. According to the DEIS, the CoalDOM and GMM models provide information for the IPM model, which "determines the least cost means to meet power sector demand for coal as part of an integrated optimal solution for power, fuel, and emissions markets. Thus, IPM is able to determine the optimal sourcing of coal for each power plant based on the predicted coal prices and transportation costs."[24] IPM is a highly sophisticated model, but it does have certain clear user-defined weaknesses that limit its value in STB's analysis.

The first weakness is that IPM's 20-year analysis period is too short to capture the total lifecycle greenhouse gas emissions from the Tongue River Railroad and the associated coalmines. As stated in the DEIS, IPM is typically used to look ahead 20 to 40 years in the future.[25] OEA chose to do its analysis from 2018 to 2037, which is at the low end of the range of IPM's capabilities, to reflect the "period of reasonably foreseeable coal production and transport by the proposed rail line."[26] The agency has forecasts for a number of important input variables that extend further into the future than 20 years, however, including peak demand and annual energy[27]and natural gas prices,[28]which extend through 2044. In addition, the mine plan submitted by Otter Creek Mine Company for its mining permit application is for a 55-year period,[29] beginning in 2018 and ending in 2072. If STB's low projection of 20 million tons of coal mined per year from the Otter Creek mine alone were summed over the expected life of the mine, this project opens up approximately 1.1 billion tons of coal. While the Otter Creek Mine Company may decide not to mine additional coal after 2037, the IPM analysis supports the development and mining of coal from Tongue River, and does not indicate that mining after 2037 would become unfavorable. Mining that occurs in any years subsequent to 2037 would result in additional emissions of greenhouse gas and other air pollutants, which are not accounted for in OEA's analysis. An additional 35 years of mining beyond OEA's analysis period would lead to significantly higher air emissions than are presented in the DEIS.

The second weakness in the IPM modeling is in STB's analysis of scenarios, as the agency chooses scenarios that present lower projected greenhouse gas emissions and omitted certain scenarios where emissions would be higher. For example, the majority of scenarios analyzed used a reference natural gas price, but the agency examined two scenarios that include a low natural gas price, because low natural

[24] DEIS Appendix C, page C.5-22
[25] DEIS Appendix C, page C.5-3
[26] DEIS Appendix C, page C.15-14
[27] DEIS Appendix C, page C.5-21
[28] DEIS Appendix C, page C.7-15
[29] DEIS Appendix C, page C.1-12, Footnote 13

gas prices increase competition with coal.[30] It did not, however, examine any scenarios with higher natural gas prices, which are common sensitivities and might be expected given the volatile history of natural gas prices. By examining low natural gas price scenarios, STB was attempting to determine whether Tongue River coal could be economically competitive, and assumed that this was certain under high natural gas prices, but it ignored the greenhouse gas implications of such a scenario. Under reference natural gas prices, Tongue River coal production is at its maximum, but total U.S. greenhouse gas emissions increases are small due to the fact that the Tongue River coal displaces other coal. Under increased natural gas prices, however, natural gas-fired generators become less competitive with coal-fired generators, and we would expect to see coal taking over for some gas-fired generators. As coal generation rises on the whole, Tongue River coal would displace smaller amounts of coal from other domestic sources, leading to a greater increase in greenhouse gas emissions under those scenarios. The scenarios that STB did examine are all weighted equally with no assigned probabilities. Omission of scenarios that would have resulted in higher greenhouse gas emissions skews STB's results and minimizes the potential emissions impact of the Tongue River Railroad and associated coalmines.

# 5. TONGUE RIVER COAL IS MORE LIKELY TO BE EXPORTED

Based on the results of its IPM modeling analysis, STB concludes that most or all of the coal produced from the mines connected to the Tongue River Railroad will be burned domestically. Several important input assumptions were made by the agency that have a direct and significant impact on the modeling results, and that are unsupported by current evidence and industry trends. Those assumptions are that: 1) domestic coal demand continues to be robust during the analysis period; and 2) Tongue River coal is of equivalent quality to other domestic coal. Rather, given the growing number of international coal plants, the ability of those coal plants to utilize blends of high-sodium coal, and the vertical integration of Arch Coal, it seems that the goal of the Tongue River Railroad and the associated mines is in fact to produce coal for export rather than for domestic use. STB points out in the DEIS that "Tongue River would be closer to export terminals than most other U.S. coal sources…(and) (p)roximity to terminals makes Tongue River coal more attractive for exporting."[31] As STB's own analysis shows, the scenarios in which Tongue River coal is exported have much higher emissions than when coal is burned domestically.

## 5.1. Demand for coal is more robust in the Pacific Basin

STB states that coal production in the Powder River Basin has increased significantly since 1970, and more than doubled between 1993 and 2008, charting this rise in Figure 2-1 in Appendix C of the DEIS. Similarly, STB states that Powder River Basin coal prices have increased over the last 20 years, and "higher prices will increase the economic feasibility of potentially induced coal production and rail

[30] DEIS Appendix C, page C.7-16

[31] DEIS Appendix C, page C.1-8

transportation."[32] In the DEIS, STB appears to assume that domestic coal production and coal prices will remain at high levels; however, evidence points to the contrary.

As noted by STB, Powder River Basin coal has historically displaced other U.S. coal at existing power plants as well as met much of the demand from new coal-fired power plants that have come online over the past 40 years.[33] During the period of rapid Powder River Basin production growth between 1993 and 2008, a number of new coal plants were still coming online or were proposed, and existing coal units were switching from higher-sulfur Eastern coal to low-sulfur Powder River Basin coal in order to comply with the Acid Rain Program established by the 1990 Clean Air Act Amendments. Natural gas prices have historically been quite volatile, and coal was the fuel of choice for many power producers.

Conditions are significantly different now. STB recognizes that there are no new coal plants being proposed in the United States at this time, and in fact, many coal plants are retiring due to the combination of increased environmental regulations for $SO_2$, $NO_x$, and Hg and low natural gas prices. Between 2012 and 2020, approximately 60 GW of coal is expected to retire in the Energy Information Administration's (EIA's) 2014 Annual Energy Outlook Reference Case. This estimate does not include retirements resulting from compliance with the Environmental Protection Agency's (EPA's) Clean Power Plan, which will likely lead to retirements of additional plants between 2020 and 2030.

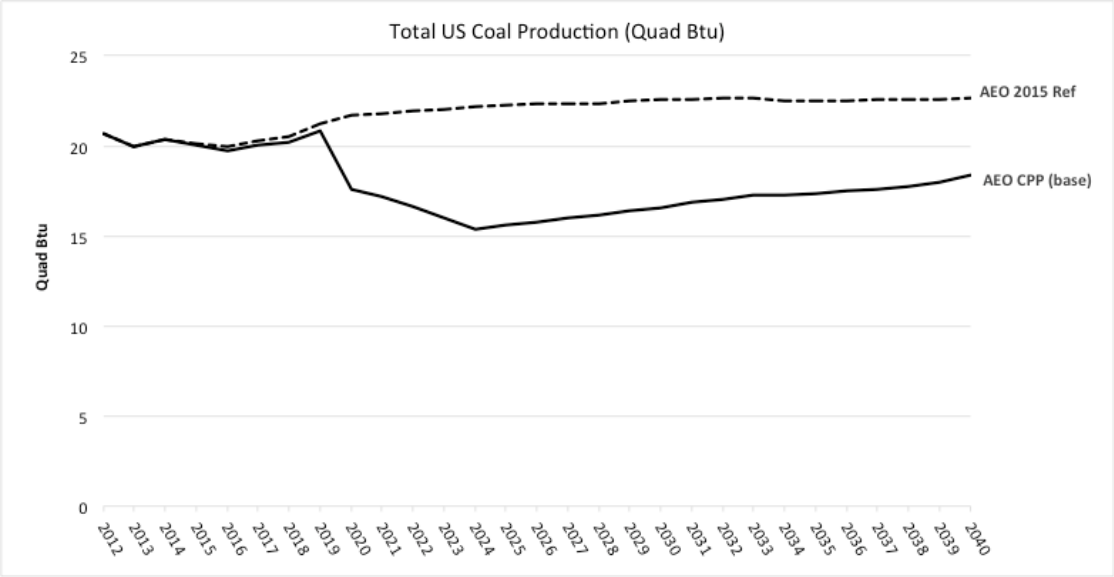
While STB acknowledges that future initiatives or regulations that limit carbon dioxide ($CO_2$) emissions could affect the domestic coal market,[34] it does not include the proposed Clean Power Plan in its IPM analysis, thus assuming that the rule, when it comes into effect, will have no impact on the market for Tongue River coal. This assumption is highly unlikely. EIA recently performed an analysis of the impacts of the proposed Clean Power Plan, concluding that U.S. coal production will fall precipitously under the Clean Power Plan base scenario relative to the AEO 2015 Reference Case forecast (see Figure 1).

[32] DEIS Appendix C, page C.2-1

[33] DEIS Appendix C, page C.1-3

[34] DEIS Appendix C, page C.2-1

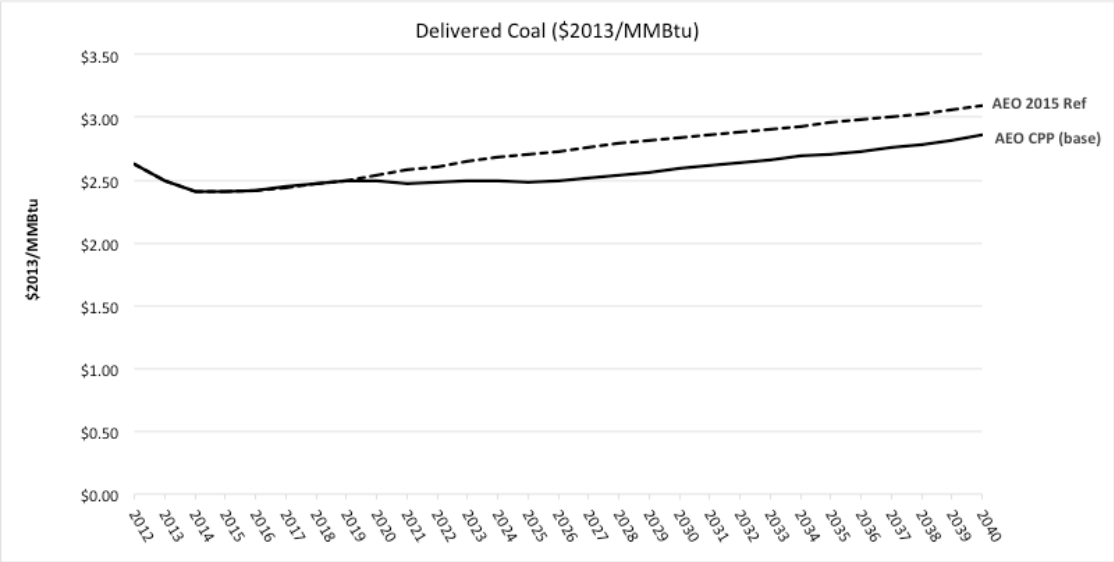
**Figure 1. Comparison of total U.S. coal production under 2015 AEO Reference and Clean Power Plan scenarios**




*Source: U.S. EIA. "Analysis of the Impacts of the Clean Power Plan." May 22, 2015.*

The EIA's analysis also forecasts declines in delivered coal prices under the Clean Power Plan scenario (see Figure 2).

**Figure 2. Comparison of delivered coal prices under 2015 AEO Reference and Clean Power Plan scenarios**




*Source: U.S. EIA. "Analysis of the Impacts of the Clean Power Plan." May 22, 2015.*

As shown in Table 5-6 in Appendix C of the draft DEIS, thermal coal demand from China and the rest of the Pacific Basin is approximately six to eight times that of the United States in the period from 2018 to

2037.[35] Thus, assuming the TRR is built and transports coal out of Montana, the only potential opportunity for this coal is on the international market. In contrast to domestic trends, coal plants continue to be built in the countries located in the Pacific Basin, particularly China. As more plants are built, coal demand grows. STB admits that "as the U.S. export terminal capacities increase, the additional Powder River Basin coal shipped to Asia would displace coal production in China, Indonesia, and Australia, **or would be used to meet the expected growing demand for coal in the Pacific Basin**."[36] [Emphasis added.] If Tongue River coal were displacing coal burned in the countries of the Pacific Basin, we would expect to see a net $CO_2$ emissions increase of zero. Given that greenhouse gas emissions are much higher in the scenarios that have higher volumes of coal exports (see Section 5.4), it appears as though exported Tongue River coal is being burned used to meet international growth in the demand for coal in those scenarios.

## 5.2. Higher sodium coal is more suited to export

Coal from Montana has higher sodium content than coal from other regions. Of the Tongue River mines, the sodium content of coal is as follows: 7.4 percent for the Otter Creek mine; 6.5 percent for the Poker Jim Creek-O-Dell Creek mine, and 4.8 percent for the Canyon Creek mine as compared to 1.5 percent for the 13 coal mines in Wyoming.[37] STB admits that high sodium content is "an undesirable characteristic"[38] and can be problematic for power plants as it can cause ash to accumulate in boilers, creating slagging and fouling conditions. STB assumes, however, that the high sodium content is not a factor that would prevent Tongue River coal from being sold in the United States.[39] This assumption seems to be based on the fact that in 2011, there were 15 power plants that purchased coal with a sodium content of 8.2 percent[40] from the Spring Creek mine. This sample—15 power plants—represents just 2.5% of the 589 coal-fired power plants reported by EIA as being in operation in the United States in 2011,[41] equivalent to one plant for every 39 in operation.[42] The domestic market for higher-sodium coal appears to be extremely small.

STB states, "Buyers consider many trade-offs between coal quality and cost when purchasing Spring Creek coal or other higher-sodium coal when lower-sodium coal is available. Many factors affect these decisions, including the customer's boiler and air pollution control equipment, coal quality, and

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[35] DEIS Appendix C, page C.5-21

[36] DEIS Appendix C, page C.8-37

[37] DEIS Appendix C, Attachment A, page A-1

[38] DEIS Appendix C, Attachment A, page A-6

[39] DEIS Appendix C, page C.3-15

[40] DEIS Appendix C, Attachment A, pages A-2 and A-5

[41] U.S. EIA. Table 4.1. Count of Electric Power Industry Power Plants, by Sector, by Predominant Energy Sources within Plant, 2003 to 2013. Available at: http://www.eia.gov/electricity/annual/html/epa_04_01.html

[42] Total capacity, in megawatts, would be better metric by which to measure the percentage of coal-fired generation that could burn high-sodium coal; however, neither the names of the 15 power plants nor their capacities were provided in the DEIS.

transportation costs."[43] The CoalDOM model that flows into IPM does include a quality variable for coal, but that refers to the rank (bituminous, lignite, and subbituminous) and sulfur content of the coal only.[44] There is no evidence in the DEIS that the CoalDOM or IPM models are able to consider differences in the sodium content of coal when making determinations about coal sales and consumption at power plants. There is also no evidence that the model is able to consider the trade-offs between coal quality and cost that are referenced by STB. Rather, STB has made the assumption that Tongue River coal is equivalent in quality to the coal that is currently being burned in the United States, and all resulting model outputs are based on this erroneous assumption.

STB notes that "(s)odium content concerns apply in both the domestic and export markets; however, in the export market, the coal is often a small part of a large blend of many coals and is of less concern in terms of boiler impact."[45] Given the faulty assumptions identified above, and the increased marketability of high-sodium coal in international markets, the conclusion that Tongue River coal will primarily serve domestic markets is highly questionable. Instead, Tongue River coal seems more likely to be exported and consumed in China and the other countries of the Pacific Basin. According to STB's own projections, these export scenarios have emissions that are much higher than those in which coal is burned domestically. Throughout the DEIS, STB states that the impacts on coal production and resulting $CO_2$ emissions of the Tongue River Railroad and coalmines are small. Focusing instead on the export scenarios, which STB admits have higher emissions, shows that STB may have in fact downplayed the climate impacts of the proposed Tongue River railroad and the associated coalmines throughout the DEIS.

## 5.3. Arch Coal's vertical integration supports export

STB states "IPM seeks to minimize coal market costs as well as electric power sector costs."[46] However, IPM does not capture other variables that may drive marketing decisions. Specifically, the proposed Tongue River Railroad would be co-owned by Arch Coal, a publicly-traded company with an interest in maximizing its profits by marketing to customers that are not are not reflected by the least-cost scenario. The goal of IPM is thus in direct conflict with Arch, the goal of which may reasonably be assumed to be profit maximization. STB admits this deficiency in the DEIS, stating that

> OEA's forecasts assumed competitive economics and certainty within each scenario. Note, however, that Arch Coal is the co-developer of the TRRC railroad, the Otter Creek Mine, and one of the export terminals, the Millennium Bulk Terminal. Hence, Arch Coal might choose to export rather than sell domestically when there are opportunities to

[43] DEIS Appendix C, Attachment A, page A-5
[44] DEIS Appendix C, page C.5-16
[45] DEIS Appendix C, Attachment A, page A-1
[46] DEIS Appendix C, page C.5-3

> maximize profits over the suite of assets that include mines, railroads, and export terminals.[47]

Given Arch Coal's vertical integration and goal of profit maximization, it seems reasonably likely that the goal of the company may be to develop coal mines for international export through its proposed export terminals.

Indeed, the proposed alignment of the Tongue River Railroad indicates that Arch has made such a marketing decision. As noted in STB's scoping report, on December 17, 2012, TRRC filed a supplemental application with STB that modified the company's preferred routing for the proposed line as the Colstrip Alterative between Colstrip, Montana, and Ashland/Otter Creek, Montana.[48] While TRRC's original proposal was to construct the railroad between Ashland and Miles City, Montana, the modified application proposed routing the railroad 50 miles to the west of Miles City, to the Forsyth Subdivision at Nichols Wye.[49] Such realignment would add significant transportation costs to Tongue River coal destined for domestic markets. On the other hand, the modified route would extend the transportation cost advantage for Tongue River coal destined for export from the West Coast. The IPM's inability to account for this apparent decision by Arch Coal to position its Tongue River coal mines for export results in a significant gap in OEA's analysis.

OEA's failure to account for the likelihood that Tongue River coal will be exported caused it to underestimate likely emissions from Tongue River coal because, as shown in the next Section, the export scenarios have higher emissions of $CO_2$.

## 5.4. Tongue River production and emissions increase significantly with exports

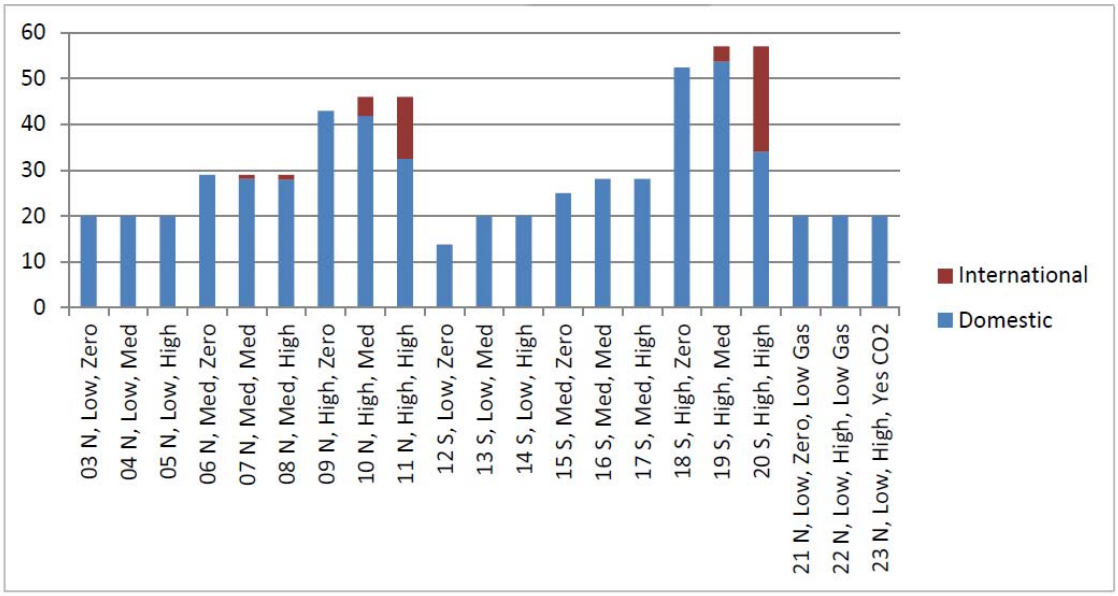
In most of the scenarios analyzed by STB, no coal from Tongue River is exported. Figure 3 shows the annual average domestic and international coal deliveries from Tongue River in the DEIS modeling. In one scenario the share of coal exported is 40 percent (scenario 20) but for most scenarios, all of the coal that is produced is sold domestically. For the northern rail alternative (noted as "N" in Figure 3), those scenarios with the highest share of exports (10 and 11) have the highest total production. The same is true for the southern alternative (noted as "S" in Figure 3), where scenario 19 and 20 have both the highest share of exports and total coal production.

[47] DEIS Appendix C, page C.8-19

[48] See http://www.tonguerivereis.com/documents/final_scope_of_study.pdf, at 1.

[49] See http://www.tonguerivereis.com/documents/final_scope_of_study.pdf, at 7.

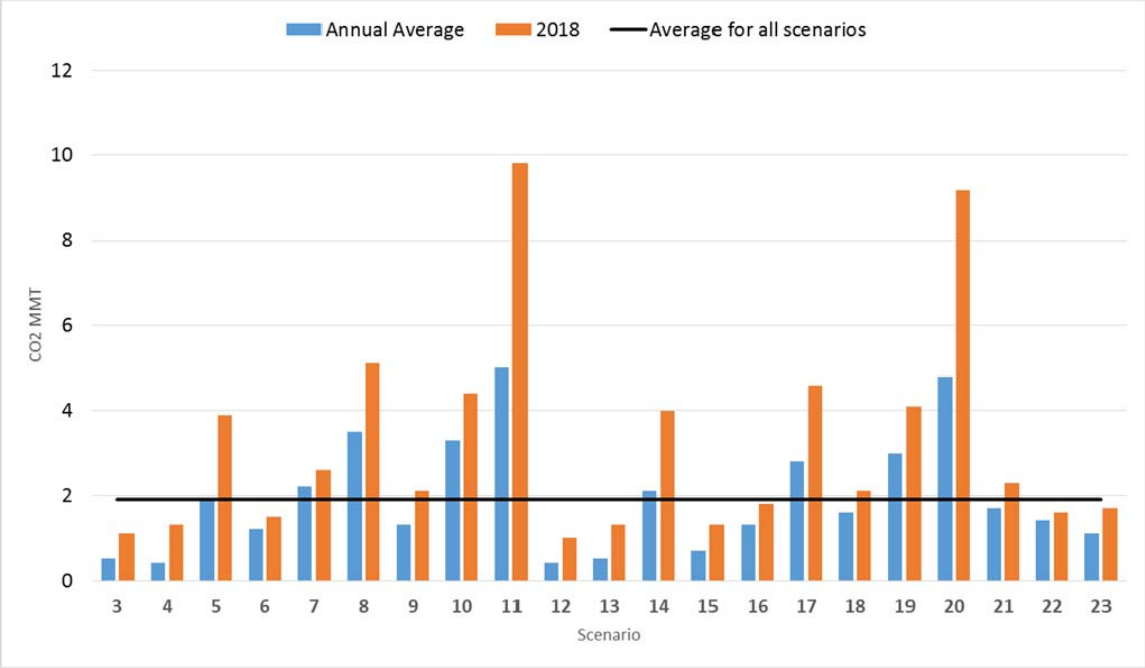
**Figure 3: DEIS Tongue River coal production, by scenario (million tons/year)**




*Source: DEIS Appendix C, Figure 8-22, p. C.8-29*

As with total coal production, shown above, $CO_2$ emissions are greater in scenarios with a higher share of coal exports. Figure 4 depicts the change in U.S. coal and natural gas emissions from the perspective of the annual average, the emissions in 2018, and the average across all scenarios.

**Figure 4: Change in U.S. $CO_2$ emissions from coal and natural gas (million metric tons per year)**




*Source: DEIS Appendix C, Table 10-7, p. C.10-8.*

Figure 4 depicts the change in U.S. coal and natural gas emissions from the perspective of the annual average, the emissions in 2018, and the average across all scenarios. On average, those scenarios with high shares of exports (11 and 20) generate about 5 million tons of $CO_2$ per year. In 2018, they each generate approximately double that: nearly 10 million metric tons in scenario 11 and 9 million tons in scenario 20. In both cases, this emission result is much higher than the 1.9 million metric ton average across all scenarios. Clearly, high coal production capacity and availability of exports lead to higher $CO_2$ emissions impacts of Tongue River coal. STB's results show that more coal would be burned in those scenarios with high international exports. This seems justified based on projections of international coal plant additions, yet there is no scenario in which all Tongue River coal is exported. This seems likely if the Tongue River railroad and the associated coalmines were to be constructed, and this scenario should have been considered and reported in STB's analysis.

# 6. CONCLUSIONS

STB did not provide access to IPM model input and output files, nor as to technical model documentation, thus severely limiting our ability to do a complete and thorough review of the DEIS analysis. Synapse's review of the DEIS report and the associated IPM analysis found them to be largely inauditable, meaning that they lack the transparency and verifiable data necessary for independent review, and thus do not provide the useful, objective tools necessary to inform a public decision-making process meant to ensure the public good. STB's analysis hinges on things that occur on the margin, whether that is with respect to coal production or electric sector dispatch. The agency did not document whether it considered the extent to which the mining of Tongue River coal might: 1) lead to variation in the delivered prices of coal; 2) cause existing coal plants to increase their production of electricity and thus lead to increased greenhouse gas emissions; and 3) delay the expected retirements of certain existing coal plants. Without the necessary data, we are unable to do that analysis. For these reasons, we recommend that agency officials and the public view the IPM modeling analysis and the conclusions of the DEIS with skepticism. The wholly transparent analysis described in Section 4 of this report is necessary before it can be determined that the development of the Tongue River Railroad and the associated coal mines will not result in significant environmental impacts.

We are, however, able to make the criticism that STB minimizes the greenhouse gas emissions associated with the Tongue River Railroad and associated coalmines by looking at a 20-year analysis period rather than over the 55-year expected life of the mines. The agency also omitted certain reasonable scenarios, i.e. a high natural gas price sensitivity, that would result in greater emissions of greenhouse gases. We can also draw the conclusion that it seems likely that Tongue River coal will be exported for international use rather than for domestic use from the information contained in the DEIS. There are several reasons that we have drawn this conclusion. First, the assumption that U.S. coal demand will remain robust is in direct conflict with the evidence that domestic demand for coal is currently declining, and will continue to decline as new environmental rules are implemented. In the Pacific Basin, on the other hand, demand for inexpensive coal continues to grow as new coal plants

come online and continue to be constructed. Second, coal from Tongue River has much higher sodium content than is typically used at domestic coal plants, and use of Tongue River coal can cause harmful slagging and fouling conditions in coal boilers when burned. International coal plants, by contrast, have experience blending higher-sodium coals with lower-sodium coals for use in their boilers, making Tongue River coal more suited to international export. Third, as the owner of the Tongue River railroad, the coalmines, and one of the proposed export terminals, Arch Coal has a financial interest in exporting Tongue River coal to the countries in the Pacific Basin. By STB's own analysis, the scenarios with higher volumes of exported coal have much higher volumes of greenhouse gas emissions.

In contrast to STB's conclusion the majority of the coal from the Tongue River mines would be burned domestically, the results of the analysis seem to point to the fact that Tongue River coal would in fact be primarily designated for export to China or other countries in the Pacific Basin. STB has presented no evidence that this coal would simply displace other coal that is burned at coal-fired power plants, and may in fact be used to meet increased international demand. STB's modeling excluded the scenario that estimated the environmental impacts if all of the coal from Tongue River was exported. In STB's own modeling scenarios, those with high exports had higher emissions than those in which the coal is used domestically. This undermines STB's conclusions that the greenhouse gas and climate impacts of the Tongue River railroad and associated coalmines would be negligible.