EXHIBIT 1

Expert Report
on Millennium Bulk Terminals-Longview/Lighthouse

Prepared for Washington State Office of the Attorney General

by Ian Goodman

In the Matter of:

LIGHTHOUSE RESOURCES, INC., ET AL. V. JAY INSLEE, ET AL.
CASE NO. 3:18-cv-05005-RJB
BEFORE THE UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT TACOMA

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1 Summary Report

1.1 Key Findings

The Goodman Group, Ltd. (TGG) has conducted a rigorous and conservative analysis of the economics of US thermal coal exports via Millennium Bulk Terminals (the Project). This analysis is based on:

- our extensive review of widely respected and influential information sources that are most significant and material; and
- our expert judgment and deep experience in economic analysis of large energy infrastructure projects.

In light of our analysis, TGG's Central Finding is that Washington State's permit denials for the Project do not significantly affect the US coal industry, nor US coal exports to Asian markets.

This Central Finding is based on the following seven Key Findings for this report:

Key Finding 1: The Applicant (Lighthouse Resources, Inc.) is a minor player in the US thermal coal industry. (Sections 4, 5 and 6)

Key Finding 2: The Project is a speculative venture that is unlikely to operate at high levels of throughput over the long-term. (Sections 5 and 7)

Key Finding 3: The Project is not needed to supply coal to Asia. Countries that could conceivably be served by exports from Millennium can easily meet their coal requirements from other sources, including Australia and Indonesia. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. (Sections 7-9)

Key Finding 4: A number of other port alternatives exist that can meet the intermittent and shrinking Asian demand for US thermal coal exports. (Sections 6, 7 and 9)

Key Finding 5: US thermal coal exports face a number of economic challenges and structural disadvantages in the global markets, which are intensifying. These competitive challenges are unrelated to port capacity and will not be overcome by Millennium. (Sections 6, 7 and 8)

Key Finding 6: The denial of the permits has no significant effect on the US domestic coal industry. (Sections 4, 6 and 7)

Key Finding 7: The Project creates very few jobs in Washington State and very few jobs in the overall US economy. (Section 10)

1.2 Coal Industry Overview (SECTION 4)

1.2.1 Types of Coal, Quality and Pricing

Coal has two primary uses: (a) **thermal coal** is used to generate electricity; (b) **metallurgical coal** is used in steelmaking. Coal is categorized into three main types, which vary widely in terms of heat and moisture content: bituminous coal (highest heat content, lowest moisture content); sub-bituminous coal (lower heat content, higher moisture); lignite (lowest heat content, highest moisture). Coal with higher heat content and lower moisture content is higher quality and the quality affects the price. Higher quality coal typically has (a) higher value to customers; (b) higher costs to produce and transport; and (c) higher sales price.

Only bituminous coal with very specific characteristics can be used as metallurgical coal. **Compared with thermal coal, metallurgical coal is of much higher quality and typically has a much higher price. Compared with sub-bituminous (thermal) coal, bituminous (thermal) coal is higher quality and typically has a much higher price.**

1.2.2 US Coal Production

Bituminous coal is produced in the Appalachian and Illinois Basins, as well as the Rocky Mountains (including the Uinta Basin). Sub-bituminous coal is primarily produced in the Powder River Basin (PRB). Lignite is produced mainly in Texas and Great Plains. Sub-bituminous coal and lignite are typically produced in surface mines. PRB coal is sub-bituminous coal produced in surface mines, some of which are very large. Bituminous coal is primarily produced in underground mines.

1.2.3 US Coal Production and Export Terminals

In the US and globally, the large majority of coal produced and consumed is thermal coal, used to generate electricity. But most US coal exports have been higher quality metallurgical coal.

Nearly all US metallurgical coal mines are located in Appalachia, proximate to the main existing US coal export terminals on the East and Gulf Coast. These terminals are in turn proximate to export markets in Europe and South America, but can be used for coal exports to other global markets (notably Asia) when coal prices are high.

Some US thermal coal production is also exported. To date, coal export terminal capacity has been relatively limited on the US West Coast. And there is significant coal terminal capacity on the Canadian West Coast in British Columbia (BC), where there is a steady market of Canadian metallurgical coal for export. The BC terminals are mainly oriented to metallurgical coal, but can also export thermal coal, including from Western US production.

Western US coal production is all thermal coal. As will be discussed below, US thermal coal production mainly supplies large domestic markets; exports are a relatively small market that is highly cyclical, uncertain and variable. Without the stability of metallurgical coal exports, the development of coal export terminals has been limited on the US West Coast.

Total existing terminal capacity far exceeds actual US coal exports. Existing terminals on the US East and Gulf Coast have a combined capacity, which is substantially greater than actual exports in any recent years. There is also terminal capacity on the Great Lakes and West Coast.

Existing West Coast terminals (in US, Canada, and Mexico) have less overall capacity than existing terminals on US East and Gulf Coast. But even this somewhat limited West Coast capacity has not been consistently utilized.

1.2.4 Coal Producers and Exporters with Nexus to Millennium

The focus in this report is on coal producers and exporters with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry. **All or almost all of the coal that might be exported via the Project would be lower quality thermal coal from Powder River Basin mines in Montana and Wyoming.**

1.2.5 Structure of the US Coal Industry and Relative Importance of Lighthouse

The US coal industry is highly concentrated with most production from a few major companies operating primarily in Wyoming and a few other states. About 70% of overall US production is in just five states: Wyoming, West Virginia, Kentucky, Pennsylvania and Illinois. In recent years, Wyoming (the largest US coal producing state) has supplied about 40% of US coal production and 90% of PRB production, whereas Montana has supplied about 4% of PRB production.

Major coal producers made numerous acquisitions around 2011 in anticipation of stronger global demand. The huge debt load and coal overproduction were not sustainable and led to the bankruptcy of many coal firms, including three of the top five producers.

Lighthouse is not now, nor has ever been, a significant US coal producer. Lighthouse thermal coal production since late 2014 is from one and a half mines: Decker (100% ownership) and Black Butte (50% ownership). **In 2016, Lighthouse production was only 4.3 million short tons (3.9 million metric tons per year), which less than 0.06% of overall US coal production and 1.3% of combined coal production of Wyoming and Montana.**

1.3 Millennium and Lighthouse are Low-Value and High-Risk (SECTION 5)

1.3.1 Millennium and Lighthouse Corporate Structure and History

The Millennium coal export terminal Project is owned by Millennium Bulk Terminals-Longview, LLC, a wholly owned subsidiary of Lighthouse Resources, Inc. (Lighthouse), a privately held company headquartered in Salt Lake City. Lighthouse (through other subsidiaries) also operates and owns two thermal coal mines:

- the Decker mine in southeast Montana/Northern Power River Basin (100% ownership) and
- the Black Butte mine in southeast Wyoming/Green River Basin (50% ownership).

Lighthouse (formerly known as Ambre Energy North America) is 92% owned by Resource Capital Funds (RCF), a mining-focused private equity firm. RCF's funds are registered in Cayman Islands for tax purposes.

1.3.2 Decker and Black Butte Mines: Lighthouse Claims and TGG Response

The Lighthouse Complaint in federal litigation claims that its mining properties can supply large volumes of coal to Asian markets, where this coal (specifically from the Decker mine) is in high demand. TGG responds to these claims by demonstrating that Decker and Black Butte are both small, older, low-value mines with high liabilities (particularly with respect to their reclamation costs).

The production profiles for both mines reflect that they are older mines where the economically viable coal resources are depleted. The lower cost, more economically viable resources have already been produced, and the production costs for the remaining resources are substantially higher than the costs at competing mines.

Moreover, an ongoing high level of exports from these mines would require large capital expenditures that are neither likely nor feasible. Furthermore, there is no meaningful nexus between the Black Butte mine or the coal deposits at Big Horn and the denial of the permits in regard to the Millennium Project. See Complaint ¶44.

1.3.3 Millennium and Lighthouse: History Demonstrates Low-Value and High-Risk

This report describes how Lighthouse assembled a set of low-value distressed assets through a series of transactions, which involved very little, if any, direct compensation. Similarly, RCF gained control of Lighthouse through a series of transactions, which involved very little, if any, direct compensation.

The history of Millennium and Lighthouse is a series of transactions demonstrating low-value and high-risk. This report analyzes this series of transactions involving these mines, Millennium, and Lighthouse itself. These transactions demonstrate that there is little if any net value for Lighthouse and/or its assets. Specifically:

- the Decker and Black Butte Mines have little if any net value;
- the Millennium Project has little if any net value;
- Lighthouse (including its assets described above) has little if any net value.

The above findings in the report are based on:

- our analysis of multiple transactions, and
- contemporaneous coal industry analyses (including on behalf of Lighthouse).

Finally, RCF, the mining-focused private equity firm that owns 92% of Lighthouse, specializes in high-risk mining-sector investments. RCF's extensive involvement and controlling share of Lighthouse is further confirmation that Millennium and Lighthouse are high-risk and have few (if any) other options for financing. Moreover, there is also significant uncertainty around RCF's continuing involvement in the Project. It is also unclear what, if any, other options there may be for Millennium and Lighthouse to obtain future financing, especially if and when RCF reduces or ends its involvement.

1.4 Potential Thermal Coal Exporters are Low-Value and High-Risk (SECTION 6)

1.4.1 Coal Exporters with Nexus to Millennium and Summary of Findings

The focus in this section is on coal producers with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry. Coal producers and exporters with significant potential nexus to Millennium are those in the Powder River Basin in both Montana and Wyoming, and especially those in Montana. TGG has identified three such coal producers and exporters:

- Lighthouse (already analyzed in Section 5)
- Arch Coal
- Cloud Peak Energy.

This report also provides a more limited analysis of other PRB coal producers and potential exporters, including Peabody, Westmoreland and Alpha/Contura/Blackjewel.

All of the coal producers and exporters identified in this section with a significant potential nexus to the Project are low-value and high-risk. The US coal industry is in a weak financial position. All of the major coal producers analyzed (with the exception of CPE) have entered into Chapter 11 bankruptcy since 2011 (including Westmoreland in October 2018). These bankruptcies were in no way the result of permit denials by State of Washington in regard to the Millennium Project.

These bankruptcies and the coal producers' actions post-bankruptcy (i.e. limiting PRB exports, relinquishing leases in the PRB, divestment and transfer of PRB mines) provide further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. Cloud Peak's decline in coal production and sales, together with its dramatic reduction in capital expenditures, is also further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options, which are intensifying.

The greatest challenge in the development of large new coal export terminals may be the weak financial situation of the US coal market and coal producers.

1.4.2 Arch Coal

Arch Coal is the second largest producer of thermal coal in the US and in the PRB. Arch is also a leading metallurgical coal producer.

Arch's strategy of developing infrastructure and mines to enable exports of PRB coal to Asia was a risky, long-term bet leading to Chapter 11 bankruptcy. This strategy resulted in over $240 million in losses on infrastructure and mines that were not permitted and not built. But if these projects had proceeded to construction, Arch would have had to spend another $735 million, and possibly substantially more. Post-bankruptcy, exports of thermal coal are a very small part of Arch operations and strategy, and Arch is not exporting PRB coal.

1.4.3 Cloud Peak Energy

Cloud Peak is the third largest coal producer in the US and third largest producer in the PRB. Other than Lighthouse, Cloud Peak Energy (CPE) may be the other coal producer with the greatest nexus with the Millennium Project. CPE solely has mines in PRB (Montana and Wyoming), hence mines that might export through Millennium. CPE is former 50% owner of Decker Mine and ongoing 100% owner of Spring Creek mine, both in Montana and both suppliers of exports to Asia. CPE has a throughput option to export via Millennium.

Compared with Lighthouse, CPE is a much larger coal producer and exporter, operating larger more competitive mines. So CPE would generally have a substantially higher value than Lighthouse. And unlike many other Powder River Basin producers and other US coal producers, CPE has not gone through bankruptcy.

Total market capitalization for CPE is now about $110 million. Put simply, if CPE is worth $110 million, Lighthouse has much less value as a coal producer. Together with the analysis of Millennium and Lighthouse in Section 1.3, this comparison with Cloud Peak further confirms that Lighthouse is a very small coal producer with low (if any) value and high-risk.

Cloud Peak is the leading PRB exporter, but exports to date have been variable and a relatively small portion of overall CPE coal production and sales. Meanwhile, Cloud Peak's domestic shipments have fallen by about 45% since 2013.

As part of the Decker Mine acquisition in 2014, Ambre also gave Cloud Peak a Millennium throughput option, originally estimated by Cloud Peak to have a value of $5 million. **But then in its 2015 financial accounting (and subsequently), Cloud Peak**

estimated that the Millennium throughput option now had zero value. The shift to a zero valuation for Millennium was part of a broader reconsideration by Cloud Peak regarding the value of export terminal capacity. Taken together, in 2015, Cloud Peak wrote off about $58 million in relation to export terminal capacity. Cloud Peak disclosed that these large write-offs were in consideration of weak export market conditions.

CPE has used existing ports and other infrastructure to export significant volumes of PRB coal when market conditions have sometimes been favorable in recent years. Put simply, even without the Project, Cloud Peak can and does export PRB thermal coal to Asia and in particular via the Westshore Terminal (in BC). CPE has confirmed that recent agreements with the Westshore Terminal (an existing lowest cost, Capesize port) provide Cloud Peak with firm export capacity foundation for many years.

1.4.4 Other PRB Coal Producers

Other PRB coal producers and potential exporters, with significant potential nexus to Millennium, include Peabody, Westmoreland and Alpha/Contura/Blackjewel.

Peabody is the largest coal producer in the US and the largest PRB producer. Westmoreland is also a major US and PRB coal producer (ranked #8 in 2016 with almost half of its production in the PRB). Alpha/Contura/Blackjewel is also a significant coal producer with mines comprising about 10% of overall PRB production.

Alpha Natural Resources entered into Chapter 11 bankruptcy in 2015. Peabody entered into Chapter 11 bankruptcy in 2016. And in October 2018, Westmoreland, a major US coal producer also entered into Chapter 11 bankruptcy.

As indicated above, these bankruptcies and the coal producers' actions post-bankruptcy (i.e. limiting PRB exports, relinquishing leases in the PRB, divestment and transfer of PRB mines) provide further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value.

1.5 The Potential for Coal Exports Via Millennium (SECTION 7)

The economic potential for significant coal exports via Millennium has decreased considerably since the Project was first investigated and proposed in 2009-2012. There have been large-scale shifts in the world energy system, which have

affected the outlook for coal demand in Asia, particularly in Millennium's key export markets (notably South Korea and Japan).

1.5.1 The Economics of Swing Supply

The US is a swing supplier to global coal markets, both generally and particularly in relation to exports via Millennium (Powder River Basin thermal coal to Asia). The US coal industry mainly supplies large domestic markets and also opportunistically exports when conditions are favorable. Export volumes are highly variable based on fluctuating market conditions, but even when export volumes are high, they are a small portion of total US thermal coal production and a tiny portion of global coal markets.

1.5.2 Intensifying Economic Challenges and Structural Disadvantages for US Exports

The US has been a swing supplier to global coal markets since the 1980s and is expected to remain so. Moreover, US thermal coal exports in general and PRB exports in particular are faced with a number of economic challenges and structural disadvantages, which are intensifying:

1. PRB exports to Asia face particular competitive disadvantages: (a) production is far from the coast and destination markets; (b) US exports must compete with lower-cost suppliers (notably Indonesia) which are advantaged by proximity and lower transport costs; and (c) PRB coal has several quality issues, which exacerbate the high cost of shipping: low heat/high moisture content and (sometimes) high sodium. As such, the US will never be at low end of the costs for seaborne thermal coal exports.

2. To access Asian export markets, PRB producers must make take-or-pay commitments, which are obligations to pay a minimum amount for rail and port use to transport the coal even if these transportation logistics go unused. Take-or-pay commitments are an additional economic risk for coal export swing suppliers because they are required to make advance reservations to supply a market that is highly uncertain and variable. When coal prices are low in the Asian markets, exports from PRB are typically not profitable for producers. Under these conditions, producers may be forced to pay the take-or-pay commitments to avoid having to export at an even greater loss (as was the case with Cloud Peak and Arch Coal using existing logistics in 2014-2016). Especially for high volume exports via Millennium, PRB producers would have to make large economically risky commitments for rail and terminal access.

3. Based on longer-term coal market projections (particularly the 2017 World Energy Outlook (WEO) from the International Energy Agency (IEA) and the

2018 Annual Energy Outlook (AEO) from the US Energy Information Administration (EIA)), the structural disadvantages for PRB coal will only intensify between now and 2040 due to the following factors:

a. According to the IEA, coal exports will decline to the more mature Asian economies (Japan, South Korea, China), but will grow elsewhere in Asia (notably in Southeast Asia and India). Demand in Asia is shifting to be less proximate to Millennium and more proximate to competitors (notably Indonesia and Australia). Therefore, the structural disadvantages (distance and transportation costs, presence of more proximate suppliers and the quality of PRB coal) are intensified. Moreover, even if these structural disadvantages could be overcome, the growth projected in the emerging Asian markets is highly uncertain.

b. WEO 2017 projects that the global market for coal exports has peaked and will decline over the long term. Thermal coal export volumes in 2040 are 5% below volumes in 2016. Because of their higher costs, US exporters have a declining portion of this declining market with export volumes in 2040 projected at 25% below volumes in 2016. AEO 2018 further projects that only a small portion of US exports will be thermal coal to Asia (7 million metric tons per year (MMTPY) in 2025 and 11 MMTPY in 2038). These projections are less than 25% of the Project's capacity of 44 MMTPY at full throughput. Moreover, these projections include US exports to Asian markets (notably India) that are typically via East and Gulf Coast ports. Put simply, neither the IEA nor the EIA projects that there will be a high volume of US thermal coal exports to Asia.

c. According to WEO 2017, one of the large-scale shifts in the global energy system is the rapid rise and falling costs of renewables and other clean energy technologies. This explosive growth spells the end of the global coal boom. Growth in renewables is expected to accelerate, while growth in coal slows. Between 2017 and 2040, renewables are projected to be the large majority of net capacity additions for electricity generation. Additions of new coal plants, which would result in more favorable market conditions for exports via Millennium, are projected to be much lower going forward than in recent years.

d. The IEA and other energy analysts have begun to take these large-scale shifts in the global energy system into account. However, there is typically a lag in most mainstream economic projections. At the time the Millennium Project was investigated and proposed (2009-2012), market conditions appeared to be more favorable for exports. This perception was based on the Asian coal boom, which was heavily influenced by China's economic growth, starting in the mid-1990s. China's coal imports are now expected to decline significantly (64%) between now and 2040 as China's energy system shifts away from coal. However, because of the lag in updating of long-term projections, an analysis based on currently available projections may still provide an overly optimistic economic outlook for Millennium. The shifts in the global energy system are large, rapid, ongoing and possibly accelerating. Hence, the long-term outlook for US coal exports may continue to worsen.

1.5.3 Export Drivers are Cyclical and Recent Higher Coal Prices Do Not Reflect Economic Fundamentals

As explained above, US coal exports from PRB face important long-term economic challenges that are projected to intensify. Coal exports are also subject to shorter-term fluctuating markets conditions that are highly uncertain and variable. Since 2006, coal prices have been highly volatile and cyclical, accompanying repeated booms and busts. Prices have rapidly increased and dropped by a half (or more).

Boom and bust cycles are common in commodity markets and especially mining. A boom is characterized by a period of rising demand and high prices, leading to capacity expansion by suppliers (e.g. new mines, ports, etc.) premised on continued growth in demand and high prices. Boom turns to bust, as oversupply leads to lower prices and market downturns, which can be prolonged.

These wide price variations dramatically affect short-term profitability and losses, but do not reflect long-term economic fundamentals. As such, the IEA in its WEO publications ignores commodity market fluctuations and assumes that these markets will self-correct. **Current relatively high coal prices should not be taken as an indicator of long-term favorable market conditions for Millennium.** The IEA along with industry observers agree that the recent price increases are short-term and not based on market fundamentals (see Figure 26). WEO 2017 and other experts concur that the recent increase in coal prices is largely based on deliberate Chinese policies (starting in 2016) to restructure its coal industry (cutting capacity and managing production in order to avoid large lay-offs and a financial crisis from coal company bankruptcies). WEO 2017 projects that this industry restructuring will be largely accomplished by the mid-2020s, and China's coal imports will then rapidly decline.

Given boom and bust cycles in the commodity markets, as well as China's coal market intervention, it would be imprudent to infer that current high prices imply long-term potential for exports via Millennium.

1.5.4 Port Capacity Not a Major Constraint on US Coal Exports

Finally, based on AEO 2018 and WEO 2017 (and earlier versions of these projections), port capacity will not be a major constraint on US coal exports and specifically coal exports to Asia. Projected coal export volumes are generally below peak volumes in recent years, which have been achieved via existing ports and other logistics.

Several existing ports/logistics can and do provide alternatives to Millennium for the export of PRB coal. These include Westshore Terminals (Metro Vancouver, BC); Ridley Terminals (Prince Rupert, BC); and ports on the US Gulf Coast and Great Lakes. Westshore, in particular, provides high-quality, low-cost, and proximate logistics, enabling sizable volumes of PRB exports when market conditions are favorable. By itself, Westshore has capacity for more than 11 MMTPY of PRB exports. **Cloud Peak (the leading PRB coal exporter) has agreements with Westshore that provide a firm export capacity foundation for many years, and Westshore now has priority rights (first call) on any coal that Cloud Peak exports.**

In summary, based on WEO 2017 and AEO 2018, **the existing economic challenges and structural disadvantages for coal exports from the PRB will intensify. The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. Therefore, the longer-term outlook for exports via Millennium has significantly deteriorated since the Project was first proposed and may in fact continue to worsen.**

1.5.5 Information Used in the Report's Analysis of Long-Term Energy Projections

TGG has extensively reviewed (and to a substantial extent relied on) information from the US government (e.g. Energy Information Administration's Annual Energy Outlook (EIA's AEO)) and intergovernmental organizations (e.g. the International Energy Agency's World Energy Outlook (IEA's WEO)); this information is widely relied on in energy analysis, including by coal producers and export terminal developers.

The IEA's WEO provides long-term energy projections for the global energy sector (https://www.iea.org/weo2017/). Hence, WEO focuses on secular trends, rather than cyclical and other shorter-term fluctuations. WEO 2017, released November 2017, (https://webstore.iea.org/world-energy-outlook-2017), provides projections for three scenarios out to 2040.

In particular, for long-term energy projections related to US coal exports to Asian markets, we have cited WEO 2017 extensively. We have also relied on previous versions of WEO (WEO 2016 https://webstore.iea.org/world-energy-outlook-2016 and 2015 https://webstore.iea.org/world-energy-outlook-2015); IEA Coal 2017: Analysis and Forecasts to 2022 (formerly, the Medium-Term Coal Market Report), released in December 2017 (https://webstore.iea.org/market-report-series-coal-2017); and previous versions (Medium-Term Coal Market Report 2015 https://webstore.iea.org/medium-term-coal-market-report-2015 and 2016 https://webstore.iea.org/medium-term-coal-market-report-2016).

The US EIA Annual Energy Outlook (AEO) provides long-term energy projections for the US. Like WEO, AEO also focuses on secular trends, rather than cyclical and other shorter-term fluctuations. AEO 2018 (released February 2018) provides projections for multiple scenarios out to 2050. https://www.eia.gov/outlooks/aeo/index.php

In our analysis of long-term energy projections, we have reviewed and relied on a multitude of different sources. But we have relied on and cited the IEA and EIA outlooks because they are authoritative, influential, consistent and widely used by energy professionals. WEO, in particular, analyzes global energy systems and was very useful for our analysis of the Asian markets. Many industry experts rely on WEO and it was one of the major sources on input information in the FEIS. It is highly detailed and granular, allowing for both quantitative and qualitative evaluation of export markets. The IEA and EIA outlooks are also very useful because they are published on an annual basis so they provide a historical data set, as well as the ability to compare projections year over year.

1.6 Key Export Markets and Drivers (SECTION 8)

Table 6 (reproduced from Section 8) summarizes the results of calculations of the projected change in thermal coal imports by key market or market driver for exports from Millennium.

Table 6: Summary of TGG Calculations of Projected Change in Thermal Coal Imports by Region, 2016-2040

Key Market/Driver	2016 Imports	2040 Imports	Change 2016-2040
	(MMTPY)	(MMTPY)	(MMTPY)
Korea	100	45	(55)
Japan	138	95	(43)
China	196	70	(126)
India	152	177	25
Other Developing Asia = Other Asia + SE Asia	153	313	160
Europe	192	127	(65)
Korea + Japan	238	140	(98)
Korea + Japan + China	434	210	(224)
All Asia	739	700	(39)
Europe + Asian Market Drivers (China, India, Other Developing Asia)	693	687	(6)
All Asia + Europe	931	827	(104)

Note 1: Key Markets are in blue; Market Drivers are in green; Totals are in purple.
Note 2: Sources and detailed derivation of these projections are provided for each of the calculations in Section 8.

The projected growth in exports to other developing Asia (160 MMTPY) will be more than offset by the projected shrinkage (224 MMTPY) in exports to major Asian markets (Japan, Korea, and China). At a time when Millennium could export 44 MMTPY (at full throughput), thermal coal markets will shrink by approximately:

- 98 MMTPY in Millennium's key markets (Korea and Japan);
- 224 MMTPY in Asian markets most proximate to Millennium;
- 39 MMTPY in all Asian markets;
- 6 MMTPY in Key Market Drivers for Millennium (defined below as Europe, China, India and other developing Asia;
- 104 MMTPY in all Asian and Europe markets and drivers.

The Complaint focuses on two countries (South Korea and Japan) as markets for coal via Millennium. Moreover, Lighthouse has some existing contracts to supply South Korea with PRB coal from the Decker Mine.

Likewise, this report identifies these large proximate Asian coal importers (South Korea and Japan) as key markets for US exports via Millennium. This report also identifies other coal importers as key market drivers, i.e. key drivers of market

conditions for US exports via Millennium. The key drivers are China, India, other developing Asia (including Southeast Asia and Taiwan), as well as Europe.

In the more mature Asian markets (including South Korea and Japan, the two key markets identified for the Project), thermal coal imports are expected to decline considerably by 2040 while policies favor a shift to renewables. **In the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market is projected to <u>shrink</u> by 55 MMTPY in South Korea and to <u>shrink</u> by 43 MMTPY in Japan (by 2040, based on WEO 2017). These significant long-term drops in imports in the two key markets for the Project are highly unfavorable for US exports from Millennium.**

Thermal coal exports via Millennium are unlikely to be a competitive source of supply to the key market drivers (China, India, other developing Asia and Europe). Nonetheless, there are market linkages in the Asian and global coal markets, such that a weaker market for coal imports in the key drivers would be overall unfavorable for Millennium.

More proximate competing coal suppliers can and do export to destination markets in both Asia and Europe. With weaker markets for coal imports the Asian market drivers, competing coal supply is pushed towards key Asian markets (i.e. South Korea and Japan). Likewise, with weaker markets for coal imports in Europe, competing coal supply is pushed towards Asian markets. As discussed above, the US is a swing supplier to global coal markets, and particularly to Asian thermal coal markets where supply from the US is structurally disadvantaged; competing suppliers are more proximate and have lower costs to supply these markets. **Hence, with weaker markets for coal imports in the Asian market drivers and Europe, markets for US exports to South Korea and Japan will also be less favorable, especially for exports via Millennium.**

The report reviews each of the six key markets and market drivers for exports via Millennium. Each regional review considers IEA projections for thermal coal exports in each of the regions, supplemented by market analysis validated by range of industry experts. Based on these projections and analyses, each review also provides a projected change in thermal coal imports by region (summarized in Table 6 above). The six regional reviews are summarized the following subsections.

1.6.1 South Korea (Key Market)

In 2017, following the election of President Moon Jae-in, South Korea announced a major policy shift away from coal and nuclear and towards renewables, LNG and increased energy efficiency. WEO 2017 estimated that Korea's coal imports (which included 100 MMTPY of thermal coal) stayed flat in 2016. **With a nearly 50% drop in**

all coal imports projected by WEO 2017, thermal coal imports decline by 55 MMTPY from the 2016 volumes to 45 MMTPY in 2040. Notably in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in South Korea is projected to shrink by 55 MMTPY.

1.6.2 Japan (Key Market)

In July 2018, Japan approved a new Strategic Energy Plan to increase renewables (including solar and wind) to 22-24% of its energy mix by 2030 while decreasing its reliance on fossil fuels. Plans for new coal plants are being scaled back and may be further scaled back.

Japan imported 138 MMTPY of thermal coal in 2016. **With an over 30% drop in coal imports projected in IEA WEO 2017, thermal coal imports would decline by 43 MMTPY from the 2016 amount to 95 MMTPY in 2040. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in Japan is projected to shrink by 43 MMTPY.**

1.6.3 China (Key Driver)

China is identified as a key market driver in this report. **WEO 2017 projects that coal imports to China will decrease by 64% by 2040, but China will remain a net importer of coal. Evolving market conditions in China (and more importantly their effect on the global coal market) are (a) overall negative for Millennium shorter-term; and (b) range from significantly to very negative for Millennium longer-term.**

China, the world's largest coal producer and consumer, was also the largest coal importer in 2016. China's dramatic economic growth starting in the mid-1990s was fueled first by domestic coal production and then supplemented by large volumes of imports. As discussed above, China's growth has also been the driving force in the Asian coal boom.

One of the four large-scale shifts in the global energy system identified by WEO 2017 is a massive shift to a cleaner energy mix for China with a rapid deployment of solar PV. Environmental concerns and falling technology costs have strengthened policy support for renewables, which have overtaken coal in net new capacity additions from 2010-2016. At the same time, coal demand, now in modest decline, is projected to continue this decline until 2040, when it will account for a significantly smaller share of China's total energy mix. Capping and then reducing coal usage are a means of addressing air pollution and a key priority in China's energy policy.

As discussed above, China's coal restructuring process has been underway. Since 2016, restructuring has resulted in a short-term increase in coal imports to China and has driven a recent increase in global coal prices. According to IEA Coal 2017, these factors are transitory and exports to China are projected to again decline, reversing the recent increases. Moreover, as a result of free trade agreements, both Indonesia and Australia now have an advantage when competing with Chinese production and that of other exporters (notably the US).

Therefore, the longer-term coal import projections and evolving market conditions in China are highly unfavorable for Millennium.

China imported 196 MMTPY of thermal coal in 2016. With the 64% drop in coal imports projected in IEA WEO 2017, thermal coal imports would decline by 126 MMTPY from the 2016 volumes to 70 MMTPY in 2040. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in China is projected to shrink by 126 MMTPY. The projected decline in exports to China (126 MMTPY) is almost three times the full throughput capacity of Millennium (44 MMTPY).

1.6.4 India (Key Driver)

Like China, India is also a key market driver of exports via Millennium. US coal exports to India are typically via East and Gulf Coast ports. Thermal coal exports via Millennium are unlikely to be a competitive source of supply to the Indian market. Nonetheless, there are market linkages, such that favorable conditions for coal exports into India would be overall favorable for exports via Millennium. Likewise, a weaker market for exports into India would be overall unfavorable for Millennium.

Evolving market conditions in India are (a) overall negative for Millennium shorter-term; and (b) range from slightly positive to significantly negative for Millennium longer-term.

As explained above, India is unlikely to provide a large growth market for thermal coal exports that would offset shrinkage in other Asian markets (notably South Korea, Japan, and China). India's coal imports declined in 2015 and 2016 and are projected to decline until at least the early-2020s; any growth longer term is projected to be small and is also highly uncertain. Furthermore, it is highly likely that even if this longer-term growth materializes, it would be served by more proximate competitors (such as Indonesia or Australia), and possibly US coal exports via East and Gulf Coast ports.

As in other Asian (and global) destination markets, conditions are evolving rapidly in India, such that thermal coal exports may continue to decline long-term. As concluded by IEA WEO 2017, this would have significant repercussions for coal exporters around the world, which have been planning on India being a large and growing market for coal exports.

India imported 152 MMTPY of thermal coal in 2016. With the 20% drop projected in IEA Coal 2017, thermal coal imports would decline by about 30 MMTPY from the 2016 volumes to 2022. IEA WEO 2017 projects that imports will then increase. Thermal coal imports in 2025 would be similar to volumes in 2016 (zero net growth), and imports in 2040 would be about 25 MMTPY higher than in 2016. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in India is projected to shrink by 30 MMTPY by 2022 and then increase, so that the market in 2040 is only 25 MMTPY greater than in 2016.

1.6.5 Other Developing Asia (Key Driver)

Other developing Asia (ODA) is a key driver for market conditions for Millennium. ODA includes the Southeast Asia region (excluding net coal exporter Indonesia), as well as the “other Asia region” (including Taiwan).

In contrast to other major markets for thermal coal imports (where imports are expected to decline), IEA WEO 2017 and Coal 2017 project that there will be substantial growth in imports to emerging markets in ODA.

Other developing Asia (including Southeast Asia and Taiwan) imported 153 MMTPY of thermal coal in 2016. With the 104% growth in these markets projected in IEA WEO 2017, thermal coal imports would increase by 160 MMTPY from the 2016 volumes to 313 MMTPY in 2040. Put another way, thermal coal imports to other developing Asia are projected to double. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in other developing Asia is projected to grow by 160 MMTPY. The projected increase in exports to other developing Asia (160 MMTPY) is more than three times the full throughput capacity of Millennium (44 MMTPY).

However, the projected growth in coal exports to ODA is not a strong indicator that market conditions will be overall favorable for exports via Millennium. First the projected growth in exports to ODA (160 MMTPY) will be more than offset by the projected shrinkage (224 MMTPY) in exports to major Asian markets (Japan, Korea, and China). Second, the markets that are shrinking are more proximate to Millennium, and the markets that are growing are less proximate. As explained in above, this shift in demand intensifies the structural disadvantages for exports via Millennium. To the extent that growth in exports to ODA results in favorable market conditions for exports, this will mainly benefit competing suppliers (notably Indonesia and Australia), rather than Millennium. Third, the projected strong growth in coal exports to ODA is highly uncertain. The factors that have resulted in large shifts away from coal elsewhere in Asia are also reducing potential growth in coal exports to ODA.

1.6.5.1 Taiwan (Chinese Taipei)

Compared with South Korea and Japan, Taiwan is a smaller and less proximate market for exports via ports in Washington and BC. But it is identified as an existing market by Cloud Peak and a potential market by Lighthouse.

Taiwan is already considered as part of the review of the ODA region. However, Taiwan is an advanced economy and mature (and major) market for coal imports. Because of its importance (and uniqueness) among the countries grouped in the ODA region, Taiwan is given separate consideration.

In 2016, Taiwan (Chinese Taipei) was again the world's fifth-largest coal importer, importing **59 MMTPY of thermal coal. With the 13% increase projected in IEA Coal 2017, thermal coal imports would increase by about 7 MMTPY from the 2016 volumes to 2022. But IEA Coal 2017 cautions that future coal imports are highly uncertain; imports are under pressure in Taiwan, where coal is facing growing social opposition.**

Similar to South Korea, Japan, and (increasingly) China, Taiwan is an advanced economy and mature market for coal imports. There is unlikely to be substantial future growth, and imports could decline substantially as older coal plants are phased out and electricity supply shifts towards renewables. Taiwan's electricity policy is focusing on replacing older fossil fuel units with more efficient power plants and increasing its installed capacity and generation from renewable sources to diversify fuel sources.

1.6.6 Europe (Key Driver)

Europe is also a key market driver for exports via Millennium. US coal exports to Europe are typically via East and Gulf Coast ports. Therefore, Millennium is unlikely to be a competitive source of supply to Europe. However there are market linkages in the global coal market, such that the projected weaker market for Europe will be overall unfavorable to Millennium.

WEO 2017 projects that European Union coal imports will decrease by 43% by 2040. The EU has established the following minimum targets for the year 2030: a 40% cut in greenhouse gas emissions (from 1990 levels) and a 27% share for renewable energy of total final energy consumption. WEO 2017 projects that these policies will result in a shift away from coal with coal demand declining by over 60% over the next 25 years, the biggest decline in any global region. With domestic production dropping even more steeply, coal imports to all of Europe (including EU) will decrease by 33% by 2040.

Europe imported 192 MMTPY of thermal coal in 2016. With the 33% drop in all coal imports projected in IEA WEO 2017, thermal coal imports would decline by 65 MMTPY from the 2016 volumes to 127 MMTPY in 2040. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in Europe is projected to shrink by 65 MMTPY. The projected decline in exports to Europe will push competing coal supply towards Asian markets, resulting in less favorable market conditions for exports via Millennium.

1.7 Lighthouse Complaint Claims and TGG's Responses (SECTION 9)

The Lighthouse Complaint makes several claims regarding South Korea. The Complaint identifies two countries, South Korea and Japan, as markets for coal via Millennium. Of these two countries, South Korea is likely to be the predominant market for potential exports via the Project. To the extent there has been any market in Asia for US thermal coal (notably PRB) production exported via Pacific Northwest ports, this market has been largely restricted to South Korea. Therefore, TGG identifies and responds to the Lighthouse Complaint claims on South Korea in this section.

First TGG identifies and responds to the Lighthouse claim that South Korea is a large and growing coal importer. Contrary to Lighthouse's claim, South Korea will be a smaller and shrinking thermal coal importer and a smaller and shrinking potential market for exports via Millennium.

Second, TGG identifies and responds to the Lighthouse claims regarding Lighthouse contracts with South Korean utilities. Contrary to Lighthouse's claim, Lighthouse's contracts with South Korean utilities did not obligate deliveries. Moreover, Lighthouse claims that there is not sufficient economic West Coast coal export capacity for Lighthouse to fulfill its contracts with Asian customers. Contrary to this claim, existing port alternatives (including Westshore) enable a large volume of US coal exports.

1.8 Project Has Few Jobs (SECTION 10)

The Project would result in few jobs in Washington and other states. Even based on (a) Lighthouse's claims for job impacts in Washington and (b) industry-friendly studies to estimate job impacts outside of Washington, **the potential job impacts from the Project are very small, especially in the context of the overall state economies, and tiny in the context of the overall US economy.**

Jobs, including spin-offs, are a useful indicator of the broader economic benefits of projects, such as Millennium. Other economic activity is typically at least partially correlated with jobs (especially total jobs including spin-offs).

Potential job impacts in Washington from the Project are very small, especially in the context of the overall state economy. Even based on Lighthouse's claims (which are overstated), the Project construction and operations would result in only a few hundred jobs per year: 1350 temporary direct on-site jobs spread over a six-year construction duration (the equivalent of 225 jobs per year) and 135 permanent direct on-site operating jobs.

Lighthouse has also estimated that the Project could result in spin-off jobs off site. Including a wide range of spin-offs throughout the economy and throughout Washington (as well as direct jobs on site), the BERK Study (cited in the Complaint) claims that Project construction would result in 2650 total jobs. Over a six-year construction duration, 2650 jobs are the equivalent of only about 440 temporary jobs per year.

Likewise, the BERK Study claims that Project operations would result in a total of 300 jobs per year (including direct and spin-offs). Hence, even with spin-offs, the total jobs from the Project estimated by the BERK Study would be less than 0.01% of total Washington jobs. However, Lighthouse's jobs claims are overstated and cannot be relied upon in determination of Project impacts. Therefore, more realistic estimates of potential jobs from Project construction and operations would be even more negligible than would be concluded based on Lighthouse's estimates.

Similarly, potential job impacts outside Washington related to the Project are also very small to non-existent. To analyze jobs outside Washington, the study evaluates mining jobs and spin-offs related to Millennium in Montana and Wyoming, the states of origin for most (if not all) of the coal to be exported via the Project.

TGG's initial evaluation is based on the maximum throughput assumption of 44 MMTPY and industry-friendly studies to estimate job impacts outside Washington. **We conclude that the mining jobs related to Millennium are very small in the context of the Montana and Wyoming economies. And they are extremely small in the context of the entire US economy.**

However based on a more realistic throughput assumption range of 0 to 44 MMTPY, total jobs in Washington from Millennium are very small in the context of the state economy. Similarly, total mining jobs in Montana and Wyoming related to Millennium are also very small (to non-existent) in the context of these state economies, and tiny (to non-existent) in the context of the US economy.

2 Introduction

2.1 Objectives of the TGG Report

In relation to U.S.D.C. (West) No. 3:18-cv-05005-RJB (*Lighthouse Resources, Inc., et al. v. Jay Inslee, et al.*) and other potential litigation, the Washington State Office of the Attorney General (AGO) retained the services of The Goodman Group, Ltd. (TGG). Ian Goodman and Brigid Rowan of TGG were retained as experts to perform the following services for the AGO:

> Conduct research and analysis regarding the natural resource costs associated with construction and operation of the Millennium Bulk Terminals–Longview coal export terminal, and the burdens on the industry if the facility is not built, for purposes of comparing the costs against the burdens in the context of a commerce clause challenge to the denial of permits for the facility.

TGG's report focuses on the burdens on the industry if the facility is not built. This report was prepared in collaboration with Brigid Rowan, TGG's Senior Economist. All work on the report has been overseen and reviewed by Ian Goodman.

2.2 Road Map for the Report

Section 1 is the **Summary Report**, which is longer and more detailed than a usual Executive Summary. It is intended for a non-technical audience to facilitate their understanding of the report and our findings. The Summary Report's subsections point the reader to the key and relevant sections in the main report, which support the points in the Summary Report.

The Summary Report starts with the central finding of the report is **that Washington State's permit denials for the Project do not significantly affect the US coal industry, nor US coal exports to Asian markets.** This central finding is based on the seven key findings for this report, which are also described. Sections 4 through 10 contain Key Findings for their respective Sections. These section-level findings also reinforce the seven overall key findings for the report.

Section 2, the Introduction, explains the objectives of the report (Section 2.1) and provides this road map for the document (Section 2.2).

Section 3 explains TGG's Approach to Analysis. Our approach relies on information sources that are most significant and material, high quality, and useful for an analysis that is rigorous and conservative (Section 3.2). Section 3.3 describes protocols for types of coal and units.

Section 4 provides a **Coal Industry Overview**. The section starts with a general primer on the types of coal (Section 4.3) and coal quality and pricing (Section 4.4). The focus in this report is on coal producers and exporters with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry.

Section 4.5 therefore introduces US coal production and provides maps of coal producing regions, including Powder River Basin. Section 4.6 discusses US coal exports and export terminal capacity and demonstrates that total existing terminal capacity far exceeds actual coal exports. Section 4.7 examines more specifically US coal production and exports and their nexus to Millennium. We determine that all or almost all the coal that might be exported via the Project would be lower quality thermal coal from the PRB in Montana and Wyoming. Finally Section 4.8 discusses the structure of the US coal industry, including its high concentration both in terms of geography and corporate ownership. This section shows definitively that Lighthouse is a very small player in the US coal industry with respect to coal production and size of mines.

Section 5 demonstrates in multiple ways that **Millennium and Lighthouse are Low-Value and High-Risk.**

Section 5.3 provides an overview of the corporate structure and history of Millennium.

Section 5.4 identifies the Lighthouse Complaint claims regarding the Decker and Black Butte mines, as well as Big Horn Coal Company. Lighthouse is claiming that its mining properties can supply large volumes of coal to Asian markets, where this coal (specifically from the Decker mine) is in high demand.

In Section 5.5, TGG responds to these claims by demonstrating that Decker and Black Butte are both small, older and low-value mines with high liabilities (particularly with respect to their reclamation claims).

Section 5.6 describes how Lighthouse assembled a set of low-value distressed assets through a series of transactions, which involved very little, if any, direct compensation. Similarly, RCF gained control of Lighthouse through a series of transactions, which involved very little, if any, direct compensation.

Section 6 also shows that **Potential Thermal Coal Exporters are Low-Value and High-Risk**. The focus in this section is on coal producers with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry. Coal producers and exporters with significant potential nexus to the Millennium Project are those in the Powder River Basin in both Montana and Wyoming, and especially those in Montana.

The analysis in this report focuses on three coal producers and exporters that have particular nexus with Millennium:

- Lighthouse (Section 5);
- Arch Coal (Section 6.3); and
- Cloud Peak Energy (Section 6.4).

This report also provides a more limited analysis of other PRB coal producers and potential exporters, including Peabody, Westmoreland and Alpha/Contura/Blackjewel (Section 6.5).

Section 7 analyzes the **Potential for Coal Exports via Millennium.** Section 7.3 explains that the US is a swing supplier to global coal markets (both generally and particularly in relation to exports via Millennium) and is expected to remain so. Section 7.4 discusses the significant existing structural disadvantages and other economic challenges facing US thermal exports in general and PRB exports in particular.

Section 7.5 demonstrates that longer-term coal market projections indicate that the existing structural disadvantages for PRB coal will only intensify between now and 2040 due to a number of factors. In particular, large-scale shifts in the world energy system have affected the long-term outlook for coal demand in Asia, particularly in Millennium's key export markets: market conditions will be unfavorable overall given the shrinkage of imports in most mature Asian markets, which may only be partially offset by growth in emerging Asian markets. Taken together, the factors described in Section 7.5 demonstrate that the long-term economic potential for significant coal exports via Millennium is limited.

Section 7.6 explains the cyclical nature of export drivers. Given boom and bust cycles in the commodity markets, as well as China's coal market restructuring process, it would be imprudent to infer that current relatively high coal prices imply long-term potential for exports via Millennium. Section 7.7 shows that port capacity will not be a major constraint on US exports and specifically coal exports to Asia. Existing ports can and do provide high-quality alternatives to Millennium for the export of PRB coal.

Finally, Section 7.8 concludes with TGG's evaluation of the potential for coal exports via Millennium. The existing economic challenges and structural disadvantages will intensify. The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. Therefore, the longer-term outlook for exports via Millennium has significantly deteriorated since the Project was first proposed and may in fact continue to worsen.

Section 8, **Key Export Market Drivers**, provides the detailed basis to support the findings in Section 7. The Complaint in Federal Litigation focuses on two countries (South Korea and Japan) as markets for coal via Millennium. Moreover, Lighthouse has some existing contracts to supply South Korea with PRB coal from the Decker Mine.

Likewise, this report identifies these large proximate Asian coal importers (South Korea and Japan) as key markets for US exports via Millennium. This report also identifies other coal importers as important drivers of market conditions for US exports via Millennium. The key drivers are China, India and other developing Asia (including Southeast Asia and Taiwan), as well as Europe.

Section 8.3 explains how TGG selected the key markets and market drivers to be analyzed. Sections 8.4 to 8.9 review each of the six key markets and market drivers for exports via Millennium:

- South Korea (Key Market) (Section 8.4)
- Japan (Key Market) (Section 8.5)
- China (Section 8.6)
- India (Section 8.7)
- Other Developing Asia (including Southeast Asia and Taiwan) (Section 8.8)
- Europe (Section 8.9).

Each regional review considers IEA projections for thermal coal exports in each of the regions, supplemented by market analysis validated by range of industry experts. Based on these projections and analyses, each review also provides a projected change in thermal coal imports by region (along with sources and detailed derivation for each regional calculation).

Section 9 discusses **Lighthouse Complaint claims on South Korea and TGG Responses**.

Of the two countries (South Korea and Japan) identified in the Complaint as markets for coal via Millennium, South Korea is likely to be the predominant market for potential exports via the Project. Therefore, TGG is identifying and responding to the Lighthouse Complaint claims on South Korea in this section.

In Section 9.3, TGG identifies and responds to the Lighthouse claim that South Korea is a large and growing coal importer. The report demonstrates that South Korea will be a smaller and shrinking thermal coal importer and a smaller and shrinking potential market for exports via Millennium.

In Section 9.4, TGG identifies and responds to the Lighthouse claims regarding Lighthouse contracts with South Korean utilities. First, TGG demonstrates that contracts with South Korean utilities did not obligate deliveries. Second, TGG refutes Lighthouse's claim that there is not sufficient economic West Coast coal export capacity for Lighthouse to fulfill its contracts with Asian customers. Contrary to this claim, there are existing port alternatives (including Westshore) enable a large volume of US coal exports.

Section 10, Project Has Few Jobs, provides a detailed analysis to support to the key finding that the Project creates very few jobs in Washington State and very few jobs in the overall US economy.

As explained in Section 10.3, jobs are an indicator of broader economic benefits. Section 10.4 therefore reviews Lighthouse's claims of job impacts in Washington as outlined in their own study (the BERK study); and Section 10.5 analyzes job impacts of the Project outside Washington. Section 10.4 shows that potential jobs in Washington from the Project are very small, especially in the context of the overall state economy. Even based on Lighthouse's claims (which are overstated), the Project construction and operations would result in only a few hundred jobs per year. To analyze jobs outside Washington, Section 10.5 evaluates mining jobs and spin-offs related to Millennium in Montana and Wyoming, the states of origin of most (if not all) of the coal to be exported from the Project. TGG demonstrates job impacts outside Washington related to the Project are also very small (to non-existent) in the context of the Montana and Wyoming economies and extremely small (to non-existent) in the context of the entire US economy.

3 TGG's Approach to Analysis

3.1 Introduction

TGG's approach to analysis relies on information sources that are most significant and material, high quality, and useful for an analysis that is rigorous and conservative (Section 3.2). Protocols for types of coal and units are described (Section 3.3).

3.2 Information Sources

3.2.1 Introduction

Issues relating to the Project's potential benefits and costs/risks are highly complex and wide-ranging. In turn, there is an extensive set of potentially relevant information sources.

Issues relating to the Project's potential benefits and costs/risks have been considered in the SEPA and NEPA EIS processes. The SEPA process has produced both a DEIS[1] and FEIS.[2] The NEPA process has produced a DEIS.[3]

In addition to information provided in the SEPA and NEPA EIS processes, there is an extensive set of other potentially relevant information sources relating to the Project's potential benefits and costs/risks.

Put more simply, there is a huge amount of potentially relevant information, and (sometimes) substantial controversy regarding this information.

In this context, TGG has been selective. It is simply not feasible to review and analyze everything said by everyone. In order to best assist in weighing the benefits and costs/risks of the Project, within the constraints of available schedule and budget, TGG has focused our review and analysis on the following categories of information sources:

- information that is most significant and material (Section 3.2.2);
- information that is high-quality (Section 3.2.3);
- information that is useful for an analysis that is rigorous and conservative (Section 3.2.4).

Protocols for References are discussed in Section 3.2.5.

3.2.2 Information that is Most Significant/Material

TGG has focused on information that is potentially most significant and material in regard to evaluating the benefits and costs/risks of the Project.

3.2.3 Information that is High-Quality

TGG has focused on information that is high quality, notably in terms of being technically oriented, based on proficient data collection and analysis, as well as credible.

3.2.4 Information that is Useful for an Analysis that is Rigorous and Conservative

TGG has undertaken an analysis that is both rigorous and conservative (i.e. does not understate the potential for coal exports via Millennium and the associated benefits). In an effort to be conservative, TGG has extensively reviewed (and when possible, to a substantial extent relied upon) information from sources that are industry-friendly. Authors or sponsors of industry friendly sources are generally involved in business activities relating to energy production, transport, and consumption, and/or otherwise generally supportive of those activities.

Moreover, TGG has used information from the Plaintiffs' own studies, particularly the BERK Study[4] in our review of job impacts of the Project in Washington in Section 10.4. Likewise in our review of job impacts outside Washington in Section 10.5, we relied extensively on three industry-friendly studies, two of which are cited in the Complaint in federal litigation,[5] as well as publicly available investor information for various coal industry companies. TGG has also extensively reviewed (and to a substantial extent relied upon) information from the US government (e.g. the EIA's Annual Energy Outlook and Coal Data Browser) and intergovernmental organizations (e.g. the IEA's World Energy Outlook); this information is widely relied upon in energy analysis, including by coal producers and export terminal developers.[6]

This analysis also considers information from sources that are less industry-friendly. In an effort to be conservative, we have undertaken extensive review and analysis to validate information, including comparing information from a variety of sources, ranging from more to less industry-friendly.

This approach is consistent with the approach TGG typically applies in our analysis of energy sector activities. In our expert testimony and reports on energy infrastructure projects, TGG generally uses as a starting point the proponents' own studies, supplemented by industry studies and publicly available investor information, in evaluating the economics of the projects.[7] TGG specializes in review of highly controversial energy sector activities.[8] In these contexts, TGG follows the rigorous and conservative approach described above.

3.2.5 Protocols for References

TGG has reviewed and relied upon a very extensive and diverse set of information sources. This report typically provides references in endnotes, which usually include links to content available online.

Rather than provide multiple, redundant endnotes relating to a specific topic, a full set of references is sometimes provided in a single master endnote at the location in the document where the topic is first discussed. In these instances, the master endnote specifically identifies the portions of the report for which references are provided by the endnote.[9]

3.3 Protocols for Types of Coal and Units

The analysis in this report is oriented to the Millennium Project (which would handle only thermal coal) and Lighthouse (which produces only thermal coal at the Decker and Black Butte Mines in Montana and Wyoming).[10] Hence, the analysis in this report focuses on thermal (as opposed to metallurgical) coal.

This report refers to and provides excerpts from multiple sources. This report and sources refer to both tonnes (metric tons) and tons (short tons):

1 tonne (or metric ton) = 1.10231 tons = 2204.62 pounds;

1 ton (or short ton) = 2000 pounds = 0.90718 tonnes.

To the extent possible, this report provides data in terms of MMTPY (million metric tons per year) to facilitate comparison with Millennium Project throughput (assumed to be 44 MMTPY at Full Build-Out Operations). Data from US sources (notably US EIA) are typically in terms of tons, so especially in discussing these data, units are sometimes expressed as MMst (million short tons), with a conversion to million tonnes (or MMT) sometimes provided.[11] Nomenclature in sources varies; notably, million short tons is sometimes stated as mmst or mst.

Data (especially from international sources such as IEA) are sometimes expressed as Mtce (million tonnes coal equivalent).[12] Mtce is a measure of heat content, rather than weight (mass), so the conversion to million tonnes (and MMst) varies depending on type of coal (and its heat content).

4 Coal Industry Overview

4.1 Key Findings

This purpose of this section is to provide an overview of the coal industry with a focus on US coal producers and exporters with a significant potential nexus to the Millennium Project. This section shows **that all or almost all the coal that might be exported via the Project would be lower quality thermal coal from the Powder River Basin in Montana and Wyoming**.

The Findings from this section are supportive of two of the seven overarching Key Findings of this report (Key Findings 1 and 6 from Section 1.1):

Key Finding 1: The Applicant (Lighthouse Resources, Inc.) is a minor player in the US thermal coal industry. (Section 4.8)
Section 4.8 outlines the structure of the US coal industry and the major players and highlights the Lighthouse is not now, nor has ever been, a significant coal producer.

Key Finding 6: The denial of the permits has no significant effect on the US domestic coal industry. (Sections 4.6)
Section 4.6 demonstrates that total existing terminal capacity for US coal exports far exceeds actual coal exports.

4.2 Introduction

TGG's overview of the coal industry starts with a general primer on the types of coal (Section 4.3) and coal quality and pricing (Section 4.4).

The focus in this report is on coal producers and exporters with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry.

Section 4.5 therefore introduces US coal production and provides maps of coal producing regions, including Powder River Basin.

Section 4.6 discusses US coal exports and export terminal capacity and demonstrates that total existing terminal capacity far exceeds actual coal exports.

Section 4.7 examines more specifically US coal production and exports and their nexus to Millennium. We determine that all or almost all the coal that might be exported via the Project would be lower quality thermal coal from the Powder River Basin (PRB) in Montana and Wyoming.

Finally Section 4.8 discusses the structure of the US coal industry, including its high concentration both in terms of geography and corporate ownership. This section shows definitively that Lighthouse is a very small player in the US coal industry with respect to coal production and size of mines.

4.3 Types of Coal

Coal has two primary uses:

- Thermal coal is used to generate electricity.[13]
- Metallurgical coal is used in steelmaking.[14]

Coal is categorized into three main ranks, which vary widely in terms of heat and moisture content:[15]

- Bituminous coal: heat content ~10,260-13,000 Btu/lb;[16] moisture content usually less than 20%.[17]
- Sub-bituminous coal: heat content ~7,500-10,260 Btu/lb;[18] moisture content 20-30%.
- Lignite: heat content less than 7,500 Btu/lb;[19] high moisture content, sometimes up to 45%.

As coal varies from lower moisture content to higher, it varies from harder to softer.

Coal also varies widely in terms of other properties, including amount of trace elements (notably sulfur, ash, chlorine, sodium, and mercury content).

4.4 Coal Quality and Pricing

Coal with higher heat content is higher quality. Likewise, coal with lower content of moisture and trace elements is higher quality.

The quality of coal affects the price (usually measured in $/ton or $/tonne). Higher quality coal typically has:

- higher value to customers;
- higher costs to produce and transport;

- higher sales price.

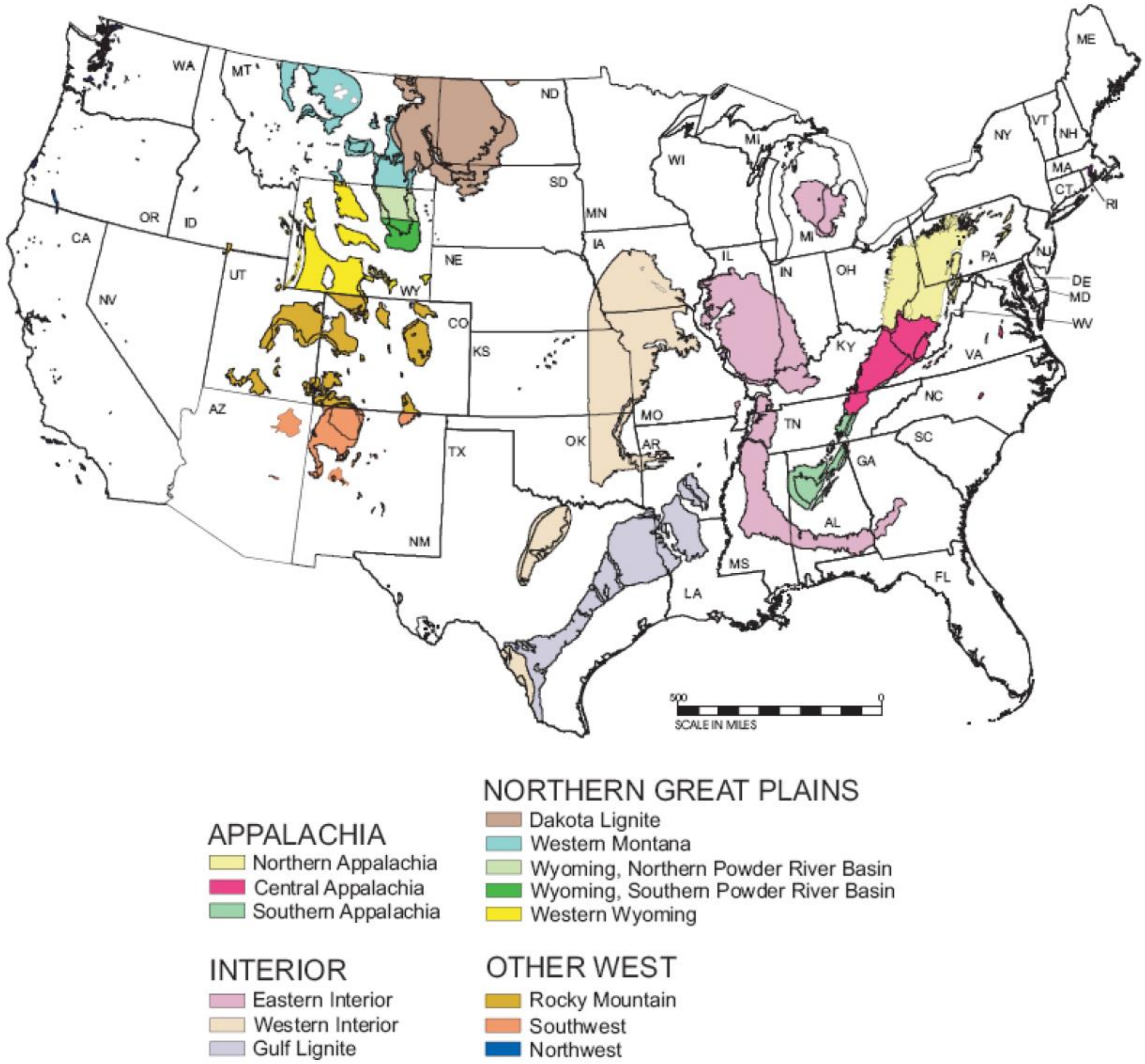
Only bituminous coal with very specific characteristics can be used as metallurgical coal.[20] Metallurgical coal also requires more cleaning than thermal coal.[21] Many types of coal are used as thermal coal, including bituminous, sub-bituminous and lignite, with widely varying sulfur content and other properties.

Compared with thermal coal, metallurgical coal is of much higher quality and typically has a much higher price. Compared with sub-bituminous (thermal) coal, bituminous (thermal) coal is higher quality and typically has a much higher price.

4.5 US Coal Production

As shown in Figure 1, US coal production includes multiple regions in the Midcontinent (from Appalachia in the east to the Mountain West).[22] Figure 2 is a close-up showing the Powder River Basin in Montana and Wyoming.

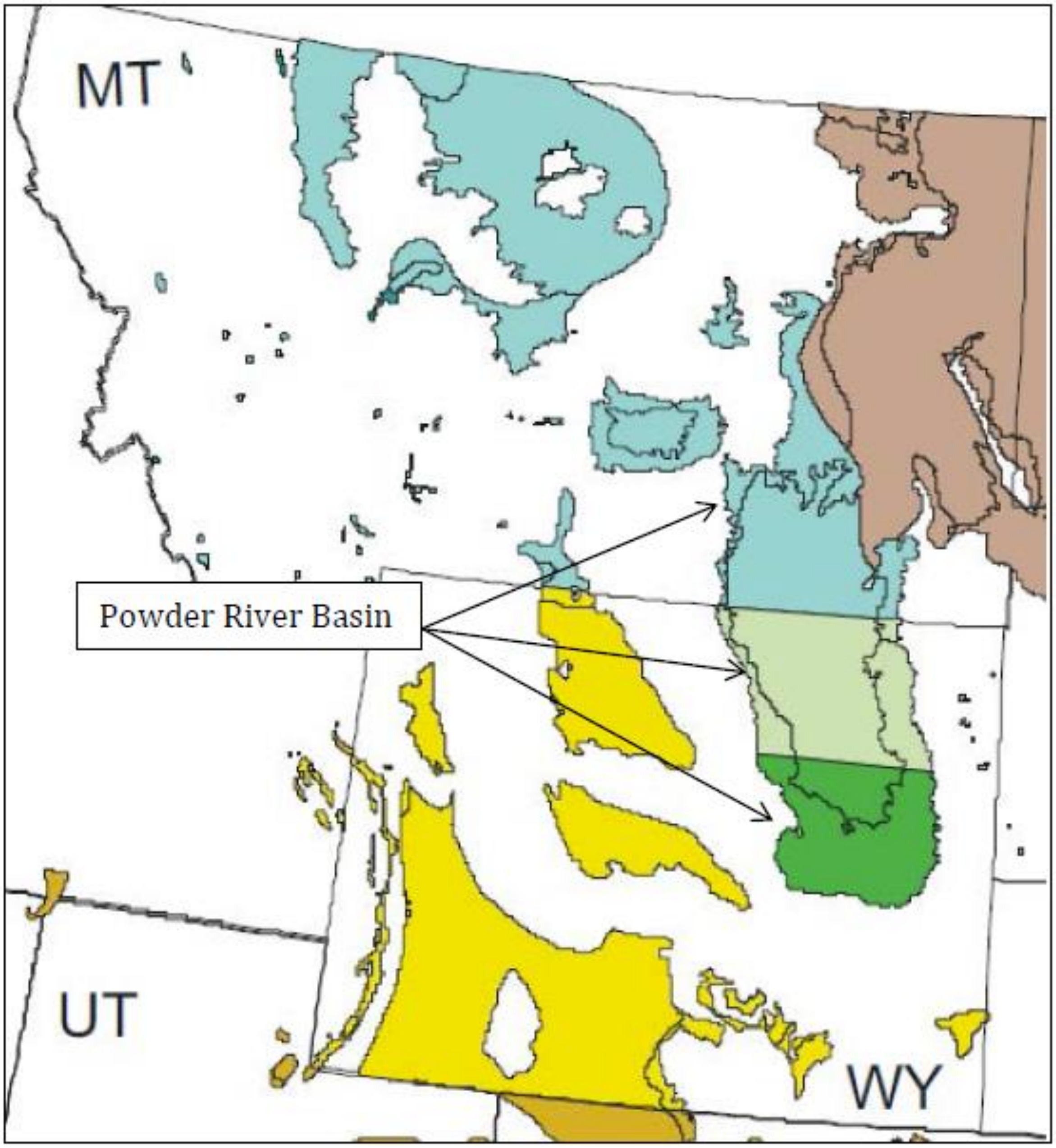
Figure 1: US Coal Production Regions



Source: U.S. Energy Information Administration, Office of Electricity, Coal, Nuclear and Renewables Analysis.

Source: EIA, Coal Market Module Model Documentation 2018, p. 6.[23]

Figure 2: Powder River Basin (Montana and Wyoming)



Source: FEIS, SEPA Coal Market Assessment Technical Report, p. 2-3.[24]

Bituminous coal is primarily produced in the:

- Appalachian Basin (Pennsylvania to Alabama, with production clustered around the borders of southern West Virginia, eastern Kentucky, and western Virginia);
- Illinois Basin (Illinois, Indiana, and western Kentucky), as well as

- Rocky Mountains (including the Uinta Basin (Colorado and Utah)).

Sub-bituminous coal is primarily produced in the Powder River Basin (Montana and Wyoming).

Lignite is produced mainly in Texas and Northern Great Plains (North Dakota and Montana).

Sub-bituminous coal and lignite are typically produced in surface mines.[25] PRB coal is all sub-bituminous coal produced in surface mines, some of which are very large. Bituminous coal is primarily produced in underground mines.

US metallurgical coal production, which is nearly all in the Appalachian Basin, comprises less than 10% of total US coal production.[26] US thermal coal production (over 90% of total US coal production) is much more widely distributed. Appalachian Basin production includes large volumes of thermal coal, as well as metallurgical coal. Production in other regions is virtually all thermal coal, including:

- bituminous coal from the Western US (including the Uinta Basin (Colorado and Utah));
- sub-bituminous coal (including from the Powder River Basin (Montana and Wyoming));
- lignite coal.

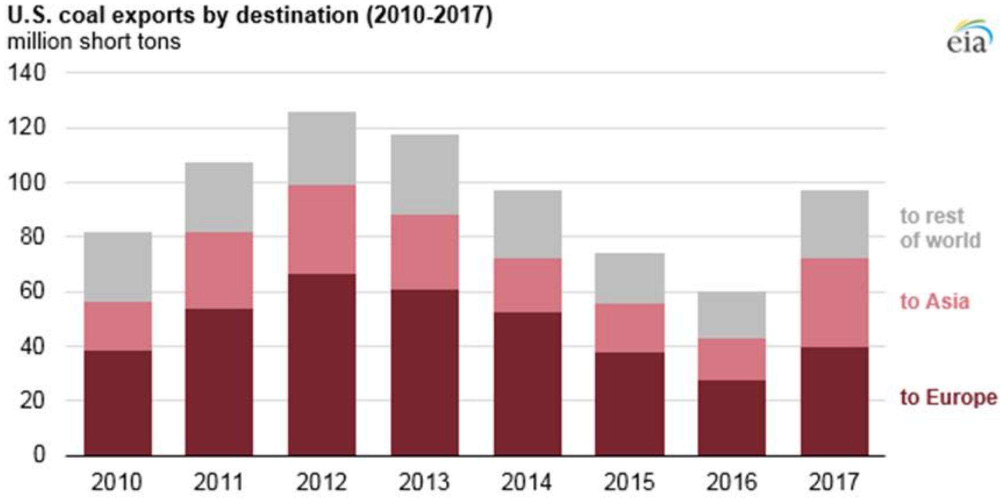
4.6 US Coal Exports and Export Terminals

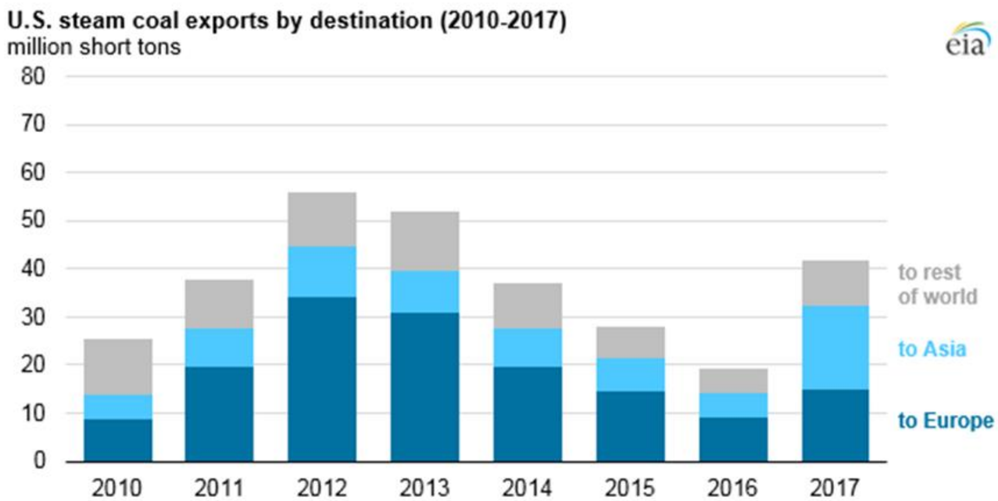
In the US and globally, the large majority of coal produced and consumed is thermal coal, used to generate electricity.[27] But as shown in Figure 3, most US coal exports have been higher quality metallurgical coal.

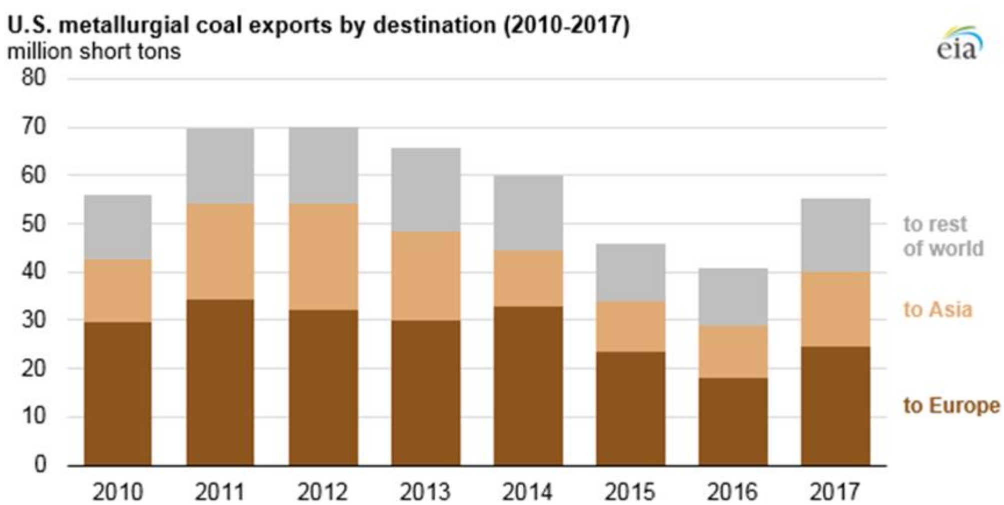
Table 1 provides a listing and key statistics for principal existing and proposed US coal export terminals on the East, Gulf, and West Coast (including ports in Canada and Mexico that handle US coal). Throughput Capacity[28] (i.e. maximum tonnage per year for a given terminal), in Column 6, is expressed as either Mt or mm units. Mt (per year) is equivalent to MMTPY and mm (per year) is equivalent to MMst (per year).

Table 2 provides a more comprehensive listing of coal export terminals, including terminals on the Great Lakes,[29] as well as some smaller terminals elsewhere, not included in Table 1. In Table 2, Current Capacity (Column 3), synonymous with Throughput Capacity, is expressed as mst (per year), equivalent to MMst (per year).

Figure 3: US Coal Exports by Type of Coal and Destination (2010-2017)







Source: EIA, Today in Energy, April 19, 2018.[30]

Table 1: Principal US Coal Export Terminals

Facility Name	Owner	Port Name	Pier	Loading Rate	Throughput Capacity	Stockpile (tonnes)	Vessel Size	Restrictions	Primary User or Destination	Access
US West Coast Ports										
Oxbow Terminal/Metro F	Koch Carbon	Port of Long Bea	G	Loader 1: 3500 tonnes/hr Loader 2: 5000 tonnes/hr	1.8 Mt	175,000	Panamax	40-50 ft	Coal & Petcoke	BNSF/UP
Metropolitan Bulk Termir	City of Stockton	Port of Stockton	12-13	Loader 1: 800 tonnes/hr Loader 2: 4000 tonnes/hr	2.6 Mt	100,000	Panamax to 50,000 tonnes to 35 ft	35 ft	Coal and other bulk commodities	UP
Levin-Richmond	Levin-Richmond Termina	Port of Richmon	22-26	12000-15000 tonnes/day	2.6 Mt	80,000	Panamax to 55,000 tonnes	Berth A: 39 ft, Berth B 30 ft	Coal and other bulk commodities	UP
Millennium Bulk Terminal	Lighthouse Resources	Port of Longview	Docks 2-3	tbd	Plan: Phase 1: 25 Mt; Phase II: 44 Mt	1.5 mm	Panamax	43 ft	Coal and other bulk commodities	BNSF/UP
Oakland Bulk and Oversized Terminal (proposed)	Oakland Global	Port of Oakland,	1	tbd	5 Mt	180,000	Cape	50 ft	Coal and other bulk commodities	BNSF/UP
Canadian and Mexican Ports Currently Handling US Coal										
Westshore Terminals	Westshore Terminals Investment Corp	Roberts Bank, BC		7000 tonnes/hr	33 Mt	2.0 mm	Cape	Berth 1: 20.9 M, Berth 2: 19.4 M	Coal & Petcoke	BNSF/CN/CP
Puerto de Guaymas	Administración Portuaria Integral de Guaymas	Guaymas, Sonora, MX		15000 tonnes/day	2 Mt (est)		Panamax		Coal and other bulk commodities	Ferromex
US EAST COAST – BALTIMORE (Atlantic Ocean via Chesapeake Bay)										
Consol Marine Terminal	Consol Energy	Port of Baltimore	CNX Pier		16 mm	1.2 mm	Cape (small)	47 ft	Coal	CSX, NS
Curtis Bay Coal Piers	CSX Railroad	Port of Baltimore	Bayside, Curtis (B&O)		14 mm	500,000	Cape (small)	41 ft	Coal	CSX
US EAST COAST – HAMPTON ROADS (Atlantic Ocean at mouth of Chesapeake Bay)										
Dominion Terminal Associates	Arch Coal 35%, Contura 65%	Port of Hampton Roads	DTA		22 mm	1.7 mm	Cape (small)	55 ft	Coal	CSX
Pier IX	Kinder Morgan	Port of Hampton Roads	Pier 9		18 mm	1.4 mm	Cape (small)	50 ft	Coal	CSX
Lamberts Point Coal Terminal	Norfolk Southern Railroad	Port of Norfolk	Pier 6		38 mm	na - Inventory held in railcars	Cape (small)	50 ft	Coal	NS
US EAST COAST – Charleston (Atlantic via)										
Shipyard River Coal Terminal	Kinder Morgan	Port of Charleston	Shipyard Bulk		2.5 mm	250,000	Panamax	45 ft	Bulk Commodities	CSX, NS
US GULF COAST (Atlantic Ocean via the Gulf of Mexico)										
McDuffie Coal Terminal	Alabama State Docks	Port of Mobile	McDuffie Island		14 mm	2.3 mm	Baby Cape	45 ft	Coal and other Bulk Commodities	CN, BNSF, NS, CSX, KCS & barge
United Bulk Terminal	Marquard & Bahls	Lower Mississippi	Mile Post 55.3 (east)		12 mm	4.0 mm	Baby Cape	47 ft at S. Pass	Coal and other Bulk Commodities	Barge
International Marine Terminal	Kinder Morgan	Lower Mississippi	Mile Post 61.0 (west)		10 mm	1.3 mm	Baby Cape	47 ft at S. Pass	Coal	Barge
Convent Marine Terminal	SunCoke Energy	Lower Mississippi	Mile Post 160.8 (east)		15 mm	1.5 mm	Baby Cape	47 ft at S. Pass	Coal	CN (IC) & Barge
Impala Burnside	Trafigura (Impala subsidiary)	Lower Mississippi	Mile Post 169.9 (east)		7.5 mm	600,000	Baby Cape	47 ft at S. Pass	Coal and other Bulk Commodities	CN (IC) proposed
Midstream Buoys	various	Lower Mississippi	Lower Mississippi		approx 20 mm	na - Inventory held in barges	Baby Cape	47 ft at S. Pass	Coal and other Bulk Commodities	Barge
Deepwater Terminal	Kinder Morgan	Houston Ship Channel	Deepwater - shares w/ Petcoke		10 mm	650,000	Panamax	40 ft	Petcoke and Coal	UP, BNSF, KCS

Source: US National Coal Council, Doyle Trading Consultants.[31]

Table 2: Total US Coal Terminal Capacity Compared with 2016 Coal Exports

Estimated U.S. Coal Port Capacity (mst) - 2017 Update

Region/Terminal	Port	Estimated Current Capacity	2016 Coal Exports By Major US Customs District [1/]
East Coast			
Baltimore, MD:			
CNX Marine	Port of Baltimore, MD	16	
Chesapeake Bay Terminal (CSX)	Port of Baltimore, MD	14	
Sparrows Point	Port of Baltimore, MD	0	
		30	**14**
Hampton Roads, VA:			
Lamberts Point (NS)	Port of Hampton Roads, VA	48	
Pier IX	Port of Hampton Roads, VA	16	
Dominion Terminal Associates (DTA)	Port of Hampton Roads, VA	22	
		86	**23**
Other East Coast:			
Fairless Hills	Philadelphia, PA	2	
Shipyard River Terminal	Port of Charleston, SC	3	
Port of Tampa	Port of Tampa, FL	2	
		7	**2**
Gulf Coast			
United Bulk Terminal	Port of New Orleans, LA	12	
International Marine Terminal	Port of New Orleans, LA	11	
Convent Marine Terminal	Lower Miss. River, LA	15	
Burnside Terminal	Lower Miss. River, LA	8	
McDuffie Terminal	Port of Mobile, AL	21	
Bulk Materials Handling Plant	Port of Mobile, AL	1	
CHIPCO Terminal (Cooper Marine)	Port of Mobile, AL	1	
Blue Creek Terminal	Port of Mobile, AL	0	
Deepwater Terminal	Port of Pasadena, TX	10	
Port of Houston (HBT)	Port of Houston, TX	5	
Port of Corpus Christi Bulk Terminal	Port of Corpus Christi, TX	0	
Other Gulf Coast and Midstream Trans.		20	
		104	**15**
Great Lakes			
Ashtabula Coal Dock	Ashtabula, OH	7	(Idled)
Sandusky Dock Pier 3	Sandusky, OH	7	
Superior Terminal	Lake Superior, WI	26	
Gateway Terminal	Port of Buffalo, NY	2	
Other Great Lakes		1	
		43	**4**
West Coast & AK			
Millenium Bulk Terminal (44 mst proposed cap.)	Columbia River, Longview, WA	0	
Long Beach Port	Long Beach, CA	2	
Levin-Richmond Terminal	San Francisco-Richmond, CA	2	
Stockton Port	Stockton, CA	2	
Seward Coal Terminal	Seward, AK	2	
		8	**3**
Non-U.S.			
Westshore Terminal	Port Metro, British Columbia	33	
Ridley Terminal	Prince Rupert, British Columbia	18	
Neptune Bulk Terminal	Port Metro, British Columbia	13	
Mexican Ports	Guaymas, Lazaro Card., Topo.	5	
		69	
Total		**347**	**60**

Source: U.S. Coal Exports website; sources and notes from original in endnote 32.

As indicated by Table 1 and Table 2, estimates of existing terminal capacity differ somewhat between sources.[33] Nonetheless, these estimates from various sources are typically broadly similar, especially for the principal terminals (which handle most of the actual export volumes).[34]

Nearly all US metallurgical coal mines are located in Appalachia, proximate to the main existing US coal export terminals on the East and Gulf Coast. These terminals are in turn proximate to export markets in Europe and South America. They also export metallurgical coal to other global markets, notably in Asia, especially when market conditions are favorable (notably coal prices are high in destination markets). See Figure 1, Figure 3, Table 1, and Table 2.

Some US thermal coal production is also exported. Coal production from Appalachia, the Illinois Basin, and (sometimes) Western US is exported via the existing terminals on the East and Gulf Coast, as well as on the Great Lakes.[35] These existing terminals enable sizable volumes of thermal coal exports to Europe, as well as to Asia, especially when market conditions are favorable.

As shown in Figure 3, thermal coal exports are highly variable year-to-year, with volumes ranging from 19 to 56 MMst since 2010; exports in the lowest year (2016) are only about one-third of volumes in the highest year (2012).

Metallurgical coal exports are also somewhat variable year-to-year, but overall much more stable than thermal coal exports. Since 2010, metallurgical coal volumes range from 41 to 70 MMst; exports in the lowest year (2016) are about 60% of volumes in the highest year (2012).

To date, coal export terminal capacity has been relatively limited on the US West Coast, and some terminals have ceased to operate owing to limited utilization and other problems.[36] In contrast to the US West Coast, there is significant coal terminal capacity on the Canadian West Coast in British Columbia (BC). This divergence between Canada and US stems (at least in part) from the differing nature of Western coal production in the two countries.

A substantial portion of Western Canadian production is metallurgical coal for export.[37] This provides a relatively high value and stable market for coal terminals in BC, which are proximate to both Western Canadian coal production and destination markets in Asia. The BC terminals have been mainly oriented to metallurgical coal, but they also can and do export thermal coal, including from Western US production.

Western US coal production is all thermal coal. As will be further explained in Section 7, US thermal coal production is strongly oriented to domestic markets; exports are a relatively small market that is highly cyclical, variable, and uncertain. Without the high value and stability provided by metallurgical coal exports, development of coal export terminals has been limited on the US West Coast.[38] But in other locations with substantial metallurgical coal exports (US East and Gulf Coast and Canada West Coast), there has been more substantial development of terminals.

Total existing terminal capacity (as shown in Table 1 and Table 2) far exceeds actual US coal exports (as shown in Figure 3 (for 2010-2017) and Table 2 (for 2016)). As a concrete example, in Table 2, the total terminal capacity is 347 MMst and the total exports are 60 MMst (for 2016). And even with the somewhat lower terminal capacity identified in Table 1, total terminal capacity is much greater than actual coal exports. According to Table 2, existing terminals on the US East and Gulf Coast have a combined capacity exceeding 200 MMst (terminal capacity), which is substantially greater than actual exports in any recent years. There is also terminal capacity on the Great Lakes and West Coast.

As also shown in Table 1 and Table 2, existing West Coast terminals (in US, Canada, and Mexico) have less overall capacity than existing terminals on US East and Gulf Coast. Moreover, as noted above, the Canada West Coast (BC) terminals have been mainly oriented to metallurgical coal, so only a portion of this capacity is available for exports of US thermal coal.

But even this somewhat limited West Coast capacity has not been consistently utilized.[39] Coal exports and terminal throughput can vary substantially based on market conditions and numerous factors including type of coal, location, coal pricing, contractual arrangements, and logistics throughout the supply chain. This report provides a detailed analysis of potential for exports via Millennium and port alternatives (see especially Sections 7 and 9.4.2.2).

4.7 Coal Producers and Exporters with Nexus to Millennium

The focus in this report is on coal producers and exporters with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry.

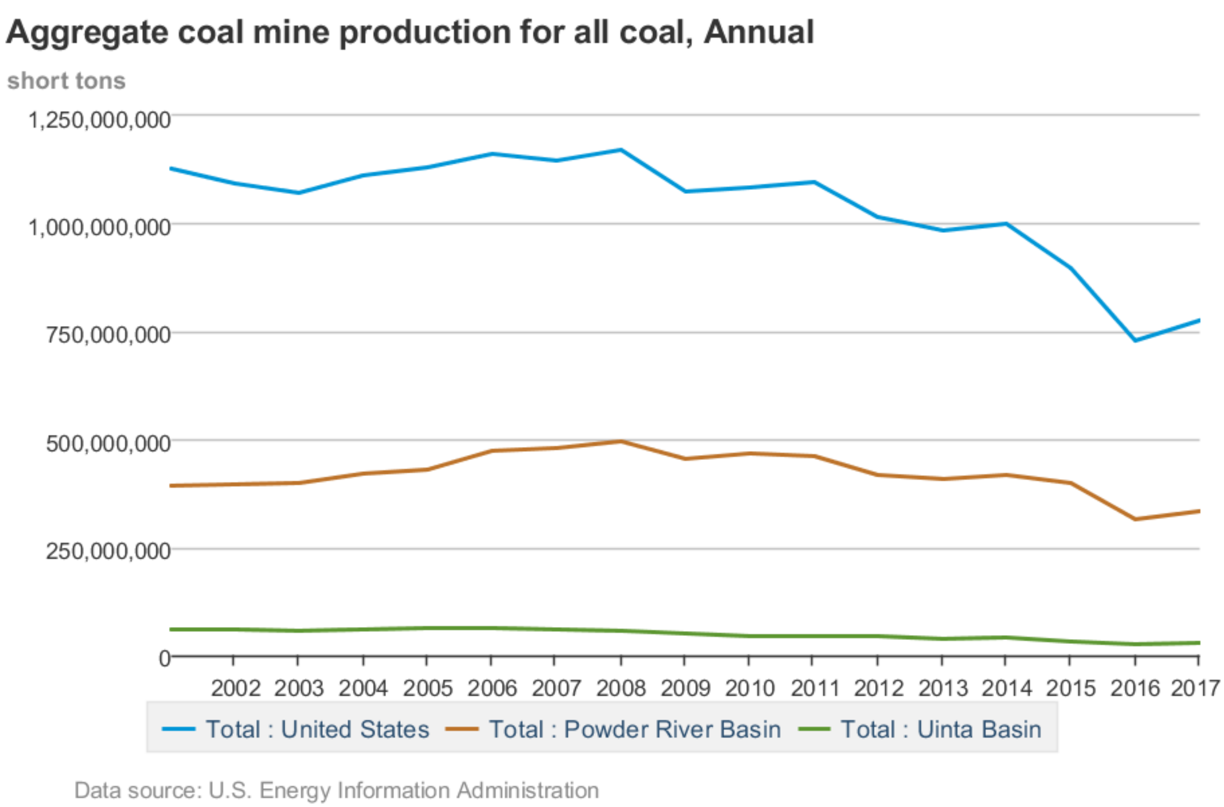
The Millennium Project would not export higher quality metallurgical coal. All of the coal exported by the Project would be lower quality thermal coal.[40] All or almost all of the coal that might be exported via the Project would come from the Powder River Basin in Montana and Wyoming:[41]

> The coal that would most likely be exported out of the proposed Pacific Northwest terminals is from the Powder River Basin, as most other coal

> basins are farther away or have other export options, such as terminals on the Atlantic or Gulf coast. The one exception is the Uinta Basin that might be competitive through the proposed coal export terminal.[42]
>
> […]
>
> The Powder River Basin, located in Montana and Wyoming, is the largest source of coal production in the United States, accounting for more than 40% of national coal production […]. Powder River Basin coal is all subbituminous coal that is mined from large surface mines.[43]

As shown in Figure 4, Powder River Basin has comprised about 42% of overall US production in recent years.

Figure 4: Coal Production in Powder River Basin, Uinta Basin, and US (2001-2017)



Source: EIA Coal Data Browser.[44]

It is possible that some coal that might be exported via the Project would come from the Uinta Basin in Colorado and Utah. But as shown in Figure 4, Uinta Basin production is relatively small, about 4% of overall US production in recent years. Moreover, Uinta

Basin production is proximate to existing West Coast export terminals in California and Mexico, and these terminals are in turn proximate to export markets in Asia and South America. Hence, the coal producers with significant potential nexus to the Millennium Project are those in the Powder River Basin.

Figure 5 provides a map of the Powder River Basin, showing mines and major undeveloped properties.

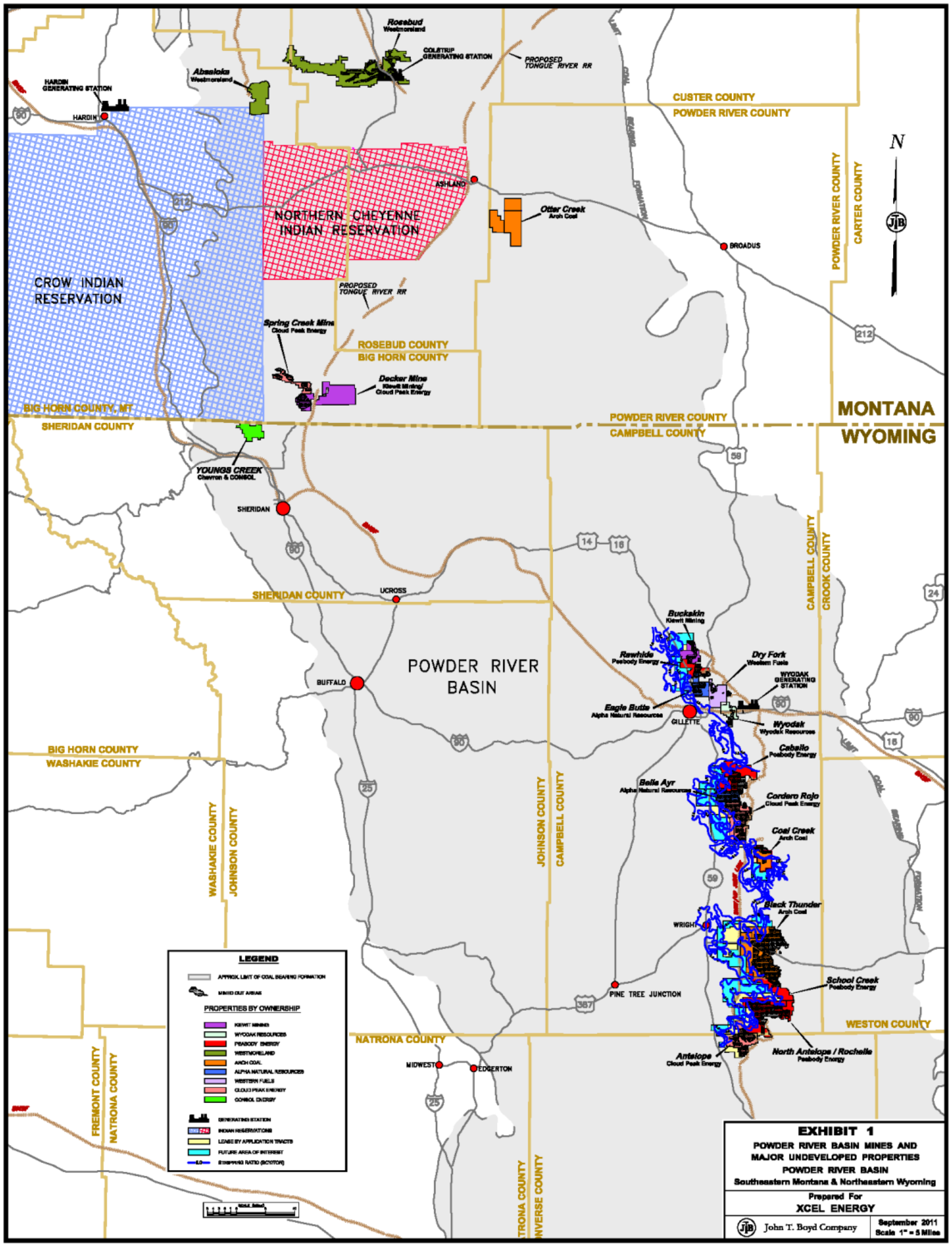
Figure 6 provides another map of the Powder River Basin, showing mines, lease areas, and average coal quality basis for each of the areas where significant mining is currently taking place or has been proposed.

To date, only about 10% of PRB coal production has been in Montana, with the remaining 90% in Wyoming.[45] But Montana PRB coal, which has a higher heat content, is more likely to be exported. Moreover, Montana PRB production is more proximate and thus typically lower cost to transport via rail for exports via the Project (and other West Coast terminals such as Westshore).

Nonetheless, especially for scenarios with high export volumes (notably the 44 MMTPY estimated for Full Build-Out Operations), supply is likely to come from Powder River Basin production in Wyoming, as well as in Montana. Compared with Montana mines, Wyoming mines are much larger (individually and collectively) and have much more capability to maintain and increase production. Also, production costs can be lower in Wyoming, such that delivered cost to Asian markets may be similar for coal from Wyoming and Montana Powder River Basin.

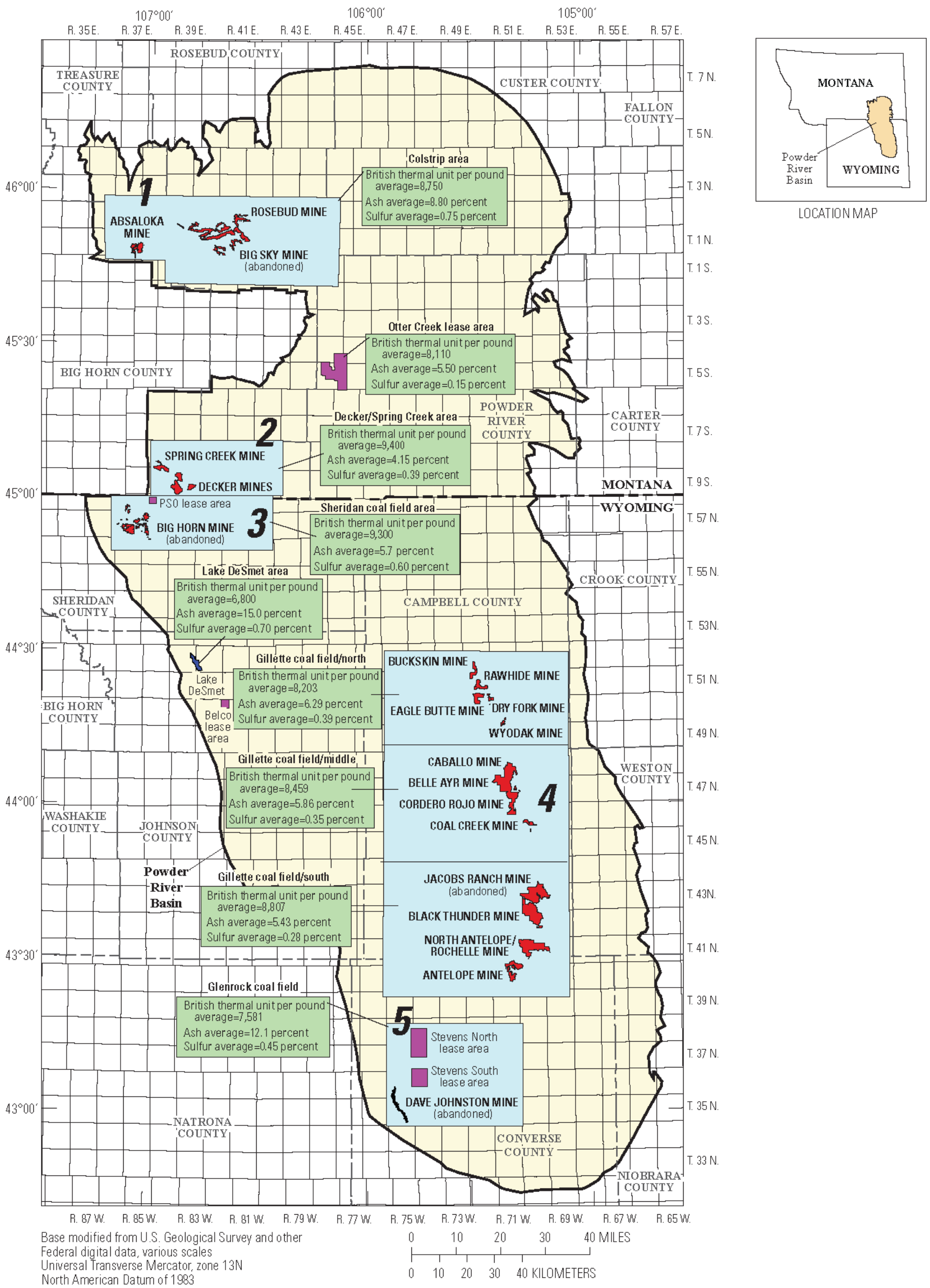
Hence, the coal producers with the most significant potential nexus to the Millennium Project are those in the Powder River Basin in both Montana and Wyoming, and especially those in Montana.

Figure 5: Map: Powder River Basin Mines and Major Undeveloped Properties



Source: John T. Boyd, Powder River Basin Coal Resource and Cost Study, 2011.[46]

Figure 6: Map: Powder River Basin Mines, Lease Areas, and Average Coal Quality



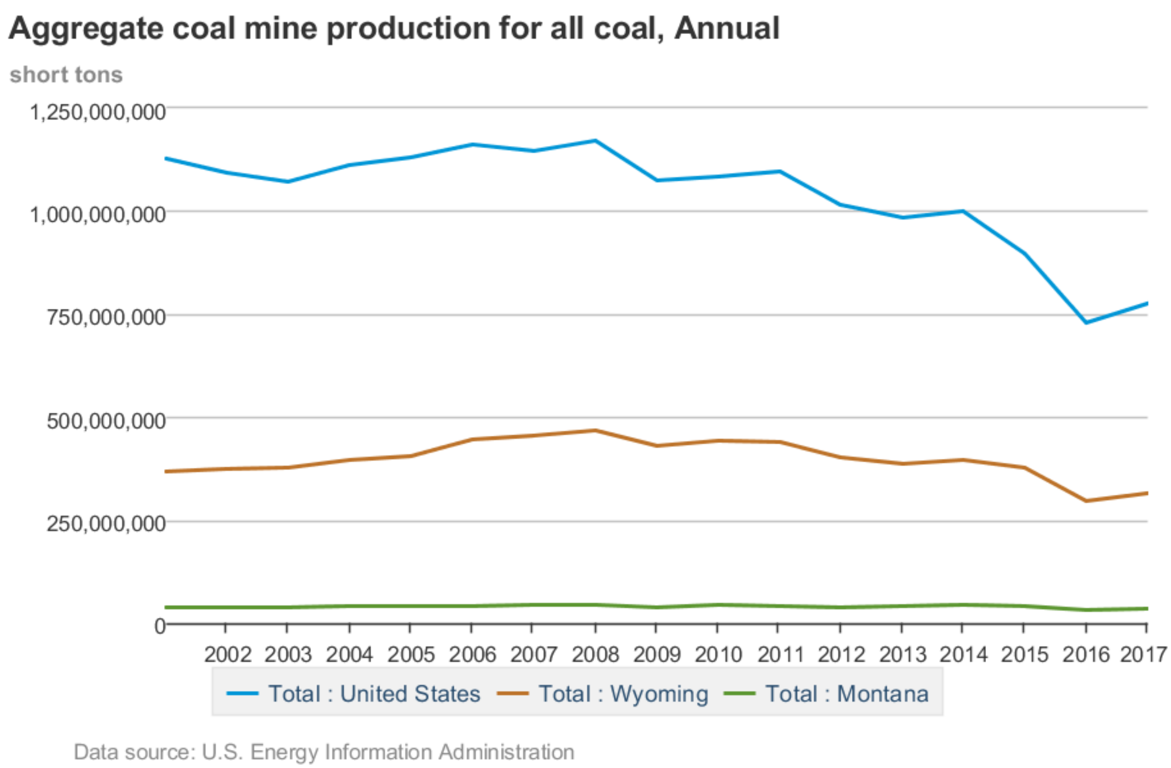
Source: USGS, Coal Geology and Assessment of Powder River Basin, Figure 13.[47]

4.8 Structure of the US Coal Industry

The US coal industry is highly concentrated. Most production is from a few major companies operating primarily in Wyoming and a few other states.

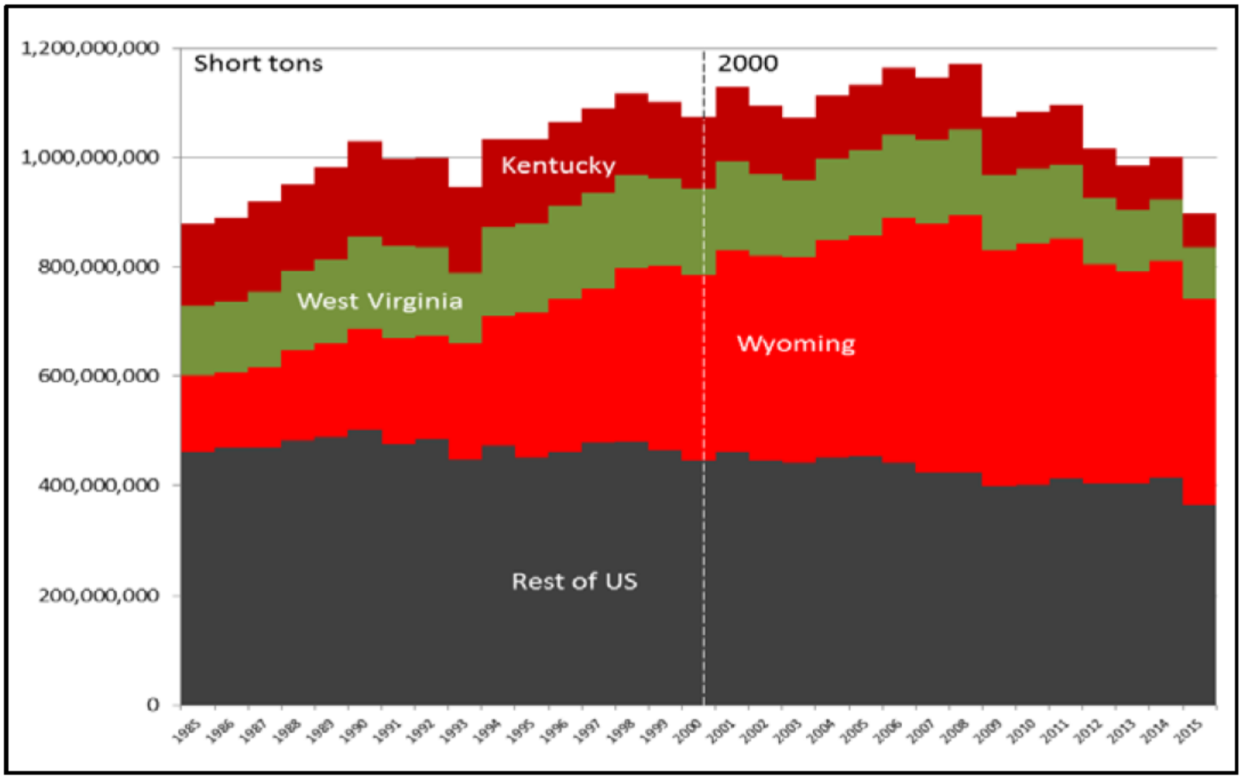
As shown in Figure 7 and Figure 8, Wyoming (with about 90% of PRB production) has comprised about 40% of overall US coal production in recent years; Montana (with about 10% of PRB production) has comprised another 4%. About 70% of overall US production is in just five states: Wyoming, West Virginia, Kentucky, Pennsylvania, and Illinois.[48]

Figure 7: Coal Production in Montana, Wyoming, and US (2001-2017)



Source: EIA Coal Data Browser.[49]

Figure 8: US Coal Production by States: 1985-2015



Source: EIA, Annual Coal Reports, 1994-2015, Analysis Group.[50]

As explained in Section 4.7, all (or almost all) of the potential coal exported via Millennium would come from coal production in Wyoming and Montana.

Major coal producers made numerous acquisitions in 2011 in anticipation of stronger global demand. The huge debt load and coal overproduction were not sustainable and contributed to the bankruptcy of many coal firms, including three of the top five producers. According a recent report on the US coal industry by the Congressional Research Service:

> **Structure of the U.S. Coal Industry**
>
> […]
>
> <u>The coal industry is highly concentrated in the United States, with just a handful of major producers, operating primarily in four states (Wyoming, West Virginia, Kentucky, and Illinois). In 2015, the top five coal mining companies were responsible for about 57% of U.S. coal production, led by Peabody Energy Corp. with 19.6% and Arch Coal Inc. with 14.6% (see</u>

Table 5 […]). Other major producers include Cloud Peak Energy, Alpha Natural Resources (ANR), and Murray Energy Corp.

In 2000, the top five producers accounted for about 46% of total U.S. coal production. That year, the two leading producers were Peabody Energy Corp., with 13.1% of production, followed by Arch Coal Inc., with 10.1% of production. The next three top producers were Kennecott Energy, CONSOL Energy Inc., and RAG-AG.

The major coal producers made numerous acquisitions in 2011 in anticipation of stronger global demand, although it was during a period of slowing domestic coal demand, weak coal prices, and more competitive natural gas supplies. The huge debt load and coal overproduction during this period was not sustainable and led to the bankruptcy of many coal firms.

Three of the top five coal producers have filed for Chapter 11 bankruptcy protection (see Table 5) since August 2015 (ANR in August 2015, Arch Coal in February 2016, and Peabody Energy in April 2016). Other major producers such as Patriot Coal, Walter Energy, and James River Coal have filed as well. All told, over 50 coal producers have filed for bankruptcy in the past two years, with a total of $19.3 billion in debt being reorganized. The three largest producers that filed for bankruptcy (Peabody, Arch, and ANR) alone accounted for 42% of U.S. coal production in 2015.[51]

Table 5. Leading U.S. Coal Producers

2015		2005		2000	
Producer	**Percent of Total**	**Producer**	**Percent of Total**	**Producer**	**Percent of Total**
Peabody Energy Corp.[ab]	19.6%	Peabody Coal Co.	17.8%	Peabody Coal Co.	13.1%
Arch Coal Inc.[b]	14.6	Rio Tinto Energy America[c]	10.9	Arch Coal Inc.	10.1
Cloud Peak Energy	8.4	Arch Coal Inc.	10.4	Kennecott Energy	9.9
Alpha Natural Resources (ANR)[b]	7.8	CONSOL Energy Inc.	5.8	CONSOL Energy Inc.	6.9
Murray Energy Corp.	6.2	Foundation Coal	5.7	RAG-AG	5.9

Source: EIA, *Annual Coal Report 2000*, *Annual Coal Report 2005*, and *Annual Coal Report 2015*.

a. Peabody Energy Corp., incorporated in 1998, was previously known as Peabody Coal.

b. Filed for Chapter 11 bankruptcy.

c. Rio Tinto Energy America (RTEA), formerly named Kennecott, was a U.S. subsidiary of the Rio Tinto Group based in England. Rio Tinto spun off Cloud Peak Energy and its RTEA mines in 2010.

[…]

> Arch Coal, ANR, and Peabody Energy have emerged from Chapter 11 with a plan to move forward, selling off some holdings. […] A major challenge for the coal industry will be to attain access to financing needed for new or expanded projects, but following their reorganization and reduced debt levels, the larger coal firms are generally expected to be in a better position to be profitable.[52]

In the above Table[53] of leading US coal producers, Lighthouse does not make the list.[54]

Lighthouse is not now, nor has never been, a significant US coal producer. Each year, EIA provides a listing of major US producers (those with more than 5 million short tons of annual production). **Lighthouse has never made the list.**

In the most recently available listing (for 2016), there were 21 major producers, comprising 88% of overall US coal production (Table 3).[55] **Lighthouse does not make this list.**

Table 3: Major US Coal Producers (2016)

Rank	Controlling Company Name	Production (thousand short tons)	Percent of Total Production
1	Peabody Energy Corp	143,024	19.6
2	Arch Coal Inc	96,483	13.2
3	Cloud Peak Energy	58,370	8.0
4	Murray Energy Corp	46,033	6.3
5	Contura Energy Inc	44,231	6.1
6	NACCO Industries Inc	36,373	5.0
7	Alliance Resource Partners LP	35,243	4.8
8	Westmoreland Coal Company	29,594	4.1
9	CONSOL Energy Inc	24,666	3.4
10	Vistra Energy	24,247	3.3
11	Foresight Energy Labor LLC	19,040	2.6
12	Alpha Natural Resources	12,396	1.7
13	Kiewit Peter Sons' Inc	12,031	1.7
14	Blackhawk Mining LLC	11,842	1.6
15	Bowie Resources Partners LLC	10,853	1.5
16	Coronado Coal LLC	7,175	1.0
17	Western Fuels Assoc Inc	6,141	0.8
18	Sunrise Coal LLC	6,113	0.8
19	Prairie State Energy Campus	5,913	0.8
20	Armstrong Energy Inc	5,889	0.8
21	Global Mining Group LLC	5,609	0.8
	Subtotal	**641,265**	**88.0**
	All Other Coal Producers	**87,099**	**12.0**
	U.S. Total	**728,364**	**100.0**

Note: The listed companies each produced more than 5 million short tons of coal in 2016. A controlling company of a mine is defined as the company 'controlling the coal, particularly the sale of the coal.' Most often, but not always, this is the owner of the mine.

Source: U.S. Department of Labor, Mine Safety and Health Administration Form 7000-2, 'Quarterly Mine Employment and Coal Production Report.'

Source: EIA, Annual Coal Report 2016 (highlighting added for emphasis of coal producers with mines in Wyoming and Montana (notably Powder River Basin)).[56]

As further explained in Section 5.6, Lighthouse (then known as Ambre Energy North America (AENA)) only first became a US coal producer in November 2011, with 50% ownership of Decker and Black Butte Mines; in late 2014, Lighthouse (then known as AENA) acquired the other 50% of Decker.

Lighthouse production since late 2014 is from one and a half mines: Decker (100% ownership) and Black Butte (50% ownership). **In 2016, Lighthouse production was only 4.3 million short tons (3.9 MMTPY): Lighthouse comprised less than 0.06% of overall US coal production**.[57] In 2015, Lighthouse production was also only 4.3 million short tons (3.9 MMTPY), comprising less than 0.06% of overall US coal production.

Lighthouse production from late 2011 to late 2014 was from half of two mines: 50% ownership of Decker and Black Butte. Hence, Lighthouse production in 2011-2014 was even lower than in 2015 and 2016, and Lighthouse comprised an even smaller portion of overall US production. And prior to late 2011, Lighthouse was not a US coal producer (and therefore comprised a zero portion of overall US production).

Coal producers with mines in the Powder River Basin, and more generally in Wyoming and Montana (highlighted in Table 3) are prominent in the listing of major US producers. In particular, the three largest coal producers, and a number of the other major producers, have mines in the Powder River Basin, and more generally in Wyoming and Montana; these producers comprise about half (46%) of overall US production.[58] Figure 5 provides a map showing PRB mines and their ownership.[59]

Each year, EIA also provides a listing of major US coal mines (those with more than 4 MMst of annual production). In the most recently available listing (for 2016), there were 44 major mines, comprising 71% of overall US coal production (Table 4).[60] **Lighthouse mines do not make the list.**

Mines in the Powder River Basin, and more generally in Wyoming and Montana (highlighted in Table 4) are prominent in the listing of major US mines. In particular, the six largest coal mines, and a number of the other major mines, are in the Powder River Basin, and more generally in Wyoming and Montana; these 16 major mines produced 320.5 MMst in 2016, comprising almost half (44%) of overall US production. Moreover, these 16 major mines comprised virtually all (97%) of overall production in Wyoming and Montana.[61] Figure 5 provides a map showing Powder River Basin mines and their ownership.[62]

Lighthouse mines produced only 4.3 mmst in 2016, comprised 0.06% of overall US coal production and 1.3% of overall coal production in Wyoming and Montana. Lighthouse has one mine (Decker) in the Powder River Basin, comprising about 1% of overall Powder River Basin production.[63]

Table 4: Major US Coal Mines (2016)

Rank	Mine Name / Operating Company	Mine Type	State	Production (short tons)
1	North Antelope Rochelle Mine / Peabody Powder River Mining LLC	Surface	Wyoming	92,863,811
2	Black Thunder / Thunder Basin Coal Company LLC	Surface	Wyoming	67,889,779
3	Antelope Coal Mine / Antelope Coal LLC	Surface	Wyoming	29,793,257
4	Eagle Butte Mine / Contura Coal West LLC	Surface	Wyoming	19,003,005
5	Cordero Rojo Mine / Cordero Mining LLC	Surface	Wyoming	18,332,046
6	Belle Ayr Mine / Contura Coal West LLC	Surface	Wyoming	14,883,227
7	Freedom Mine / The Coteau Properties Company	Surface	North Dakota	14,109,960
8	Bailey Mine / Consol Pennsylvania Coal Company	Underground	Pennsylvania	12,056,165
9	Mc#1 Mine / M-Class Mining LLC	Underground	Illinois	11,443,835
10	Caballo Mine / Peabody Caballo Mining, LLC	Surface	Wyoming	11,221,557
11	Marshall County Mine / The Marshall County Coal Company	Underground	West Virginia	10,523,671
12	Spring Creek Coal Company / Spring Creek Coal LLC	Surface	Montana	10,245,081
13	Enlow Fork Mine / Consol Pennsylvania Coal Company	Underground	Pennsylvania	9,638,245
14	Kosse Strip / Luminant Mining Company LLC	Surface	Texas	9,299,300
15	Rosebud Mine&crusher/Conveyor / Western Energy Company	Surface	Montana	8,812,478
16	River View Mine / River View Coal LLC	Underground	Kentucky	8,607,528
17	Coal Creek Mine / Thunder Basin Coal Company LLC	Surface	Wyoming	8,179,632
18	Rawhide Mine / Peabody Caballo Mining, LLC	Surface	Wyoming	8,079,139
19	Bear Run Mine / Peabody Bear Run Mining LLC	Surface	Indiana	7,283,179
20	Falkirk Mine / Falkirk Mining Company	Surface	North Dakota	7,248,542
21	Buckskin Mine / Buckskin Mining Company	Surface	Wyoming	7,130,578
22	Three Oaks / Luminant Mining Company LLC	Surface	Texas	6,983,347
23	Cumberland Mine / Cumberland Contura, LLC	Underground	Pennsylvania	6,959,706
24	Tunnel Ridge Mine / Tunnel Ridge, LLC	Underground	West Virginia	6,593,227
25	Harrison County Mine / The Harrison County Coal Company	Underground	West Virginia	6,586,715
26	Ohio County Mine / The Ohio County Coal Company	Underground	West Virginia	6,265,878
27	Dry Fork Mine / Western Fuels-Wyoming Inc	Surface	Wyoming	6,141,433
28	Lively Grove Mine / Prairie State Generating Company	Underground	Illinois	5,913,129
29	Bull Mountains Mine No 1 / Signal Peak Energy LLC	Underground	Montana	5,609,042
30	Kayenta Mine / Peabody Western Coal Company	Surface	Arizona	5,422,850
31	Mach #1 Mine / Mach Mining LLC	Underground	Illinois	5,406,820
32	Sufco / Canyon Fuel Company LLC	Underground	Utah	5,375,171
33	Century Mine / American Energy Corporation	Underground	Ohio	4,983,672
34	Buchanan Mine #1 / Buchanan Minerals, LLC	Underground	Virginia	4,946,468
35	El Segundo / El Segundo Coal Company, LLC	Surface	New Mexico	4,902,936
36	Skyline Mine #3 / Canyon Fuel Company LLC	Underground	Utah	4,756,924
37	Marion County Mine / The Marion County Coal Company	Underground	West Virginia	4,370,847
38	San Juan Mine 1 / San Juan Coal Company	Underground	New Mexico	4,330,717
39	Center Mine / Bni Coal, Ltd	Surface	North Dakota	4,296,307
40	South Hallsville No 1 Mine / The Sabine Mining Company	Surface	Texas	4,186,658
41	Absaloka Mine / Westmoreland Resources Inc.	Surface	Montana	4,157,548
42	West Elk Mine / Mountain Coal Company, L.L.C.	Underground	Colorado	4,156,405
43	Navajo Mine / Bisti Fuels Company LLC	Surface	New Mexico	4,107,436
44	Kemmerer Mine / Westmoreland Kemmerer, LLC	Surface	Wyoming	4,105,900
	Subtotal			**507,203,151**
	All Other Mines			**221,161,347**
	U.S. Total			**728,364,498**

Note: Major mines are mines that produced more than 4 million short tons in 2016. Company listed indicates the firm operating the mine.

Source: U.S. Energy Information Administration Form EIA-7A, 'Annual Survey of Coal Production and Preparation,' and U.S. Department of Labor, Mine Safety and Health Administration Form 7000-2, 'Quarterly Mine Employment and Coal Production Report.'

Source: EIA, Annual Coal Report 2016 (highlighting added for emphasis of mines in Wyoming and Montana (notably Powder River Basin)).[64]

5 Millennium and Lighthouse are Low-Value and High-Risk

5.1 Key Findings

Finding 1: Decker and Black Butter are small, older and low-value mines with high liabilities (particularly with respect to their reclamation requirements). (Section 5.5)

Finding 2: There is no meaningful nexus between the Black Butte mine, or coal at Big Horn, and exports via Millennium. Hence, there is no meaningful nexus between these assets and Washington State's permit denials for the Project. (Sections 5.5.6 and 5.5.7)

Finding 3: The history of Millennium and Lighthouse is a series of transactions demonstrating low-value and high-risk. (Section 5.6)

Finding 4: Lighthouse assembled a set of low-value distressed assets through a series of transactions, which involved very little, if any, direct compensation. (Section 5.6)

Finding 5: Decker and Black Butte mines, the Millennium Project and Lighthouse itself have little if any net value. (Section 5.6)

The above Findings from this section are supportive of two of the seven overarching Key Findings of this report (Key Findings 1 and 2 from Section 1.1):

Key Finding 1: The Applicant (Lighthouse Resources, Inc.) is a minor player in the US thermal coal industry. (Sections 5.5 and 5.6)

Key Finding 2: The Project is a speculative venture that is unlikely to operate at high levels of throughput over the long-term. (Sections 5.5 and 5.6)

5.2 Introduction

Section 5 demonstrates in multiple ways that Millennium and Lighthouse are low-value and high-risk.

Section 5.3 provides an overview of the corporate structure and history of Millennium.

Section 5.4 identifies the Lighthouse Complaint claims regarding the Decker and Black Butte mines (¶¶ 37, 38, 41), as well as Big Horn Coal Company (¶ 44). Lighthouse is claiming that its mining properties can supply large volumes of coal to Asian markets, where this coal (specifically from the Decker mine) is in high demand.

In Section 5.5, TGG responds to these claims by demonstrating that Decker and Black Butte are both small, older and low-value mines with high liabilities (particularly with respect to their reclamation requirements). TGG's responses to the claims are summarized in Section 5.5.1. The production profiles of both mines reflect that they are older mines where the economically viable coal resources are depleted and the remaining resources have substantially higher production costs than costs at competing mines. This is confirmed by multiple coal industry analyses. (Sections 5.5.2-5.5.5)

Moreover, an ongoing high level of exports from these mines would require large capital expenditures that are neither likely nor feasible. (Section 5.5.5). Furthermore, there is no meaningful nexus between the Black Butte mine, or the coal deposits at Big Horn, and exports via Millennium. Hence, there is no meaningful nexus between these assets and Washington State's permit denials for the Project. (Sections 5.5.6 and 5.5.7)

The next major section, Section 5.6 describes how Lighthouse assembled a set of low-value distressed assets through a series of transactions, which involved very little, if any, direct compensation. Similarly, RCF gained control of Lighthouse through a series of transactions, which involved very little, if any, direct compensation.

The history of Millennium and Lighthouse is a series of transactions demonstrating low-value and high-risk. Section 5.6 analyzes this series of transactions involving the mines, Millennium, and Lighthouse itself. These transactions demonstrate that there is little if any net value for Lighthouse and/or its assets. Specifically:

- the Decker and Black Butte Mines have little if any net value;
- the Millennium Project has little if any net value;
- Lighthouse (including its assets described above) has little if any net value.

The above findings in the report are based on:

- our analysis of multiple transactions, and
- contemporaneous coal industry analyses (including on behalf of Lighthouse).

RCF's extensive involvement is further indication that Millennium and Lighthouse are high-risk and have few (if any) other options for financing (Section 5.6.6).

5.3 Millennium and Lighthouse Corporate Structure and History

The Millennium coal export terminal Project is owned by Millennium Bulk Terminals-Longview, LLC, a wholly owned subsidiary of Lighthouse Resources, Inc. (Lighthouse), a privately held company headquartered in Salt Lake City.[65] Lighthouse (through other subsidiaries) also operates and owns two thermal coal mines:

- the Decker mine in southeast Montana/Northern Power River Basin (100% ownership) and
- the Black Butte mine in southwest Wyoming/Green River Basin (50% ownership).[66]

As explained in the Complaint in federal litigation (footnote 1):

> Lighthouse was previously known as Ambre Energy North America, Inc. In 2014, Ambre Energy North America, Inc. separated from its Australian parent company, Ambre Energy Limited, when it recapitalized. Ambre Energy North America, Inc. announced that it had changed its name to Lighthouse Resources, Inc. in April 2015.

Lighthouse is 92% owned by Resource Capital Funds (RCF), a mining-focused private equity firm.[67] RCF has offices in Denver, New York, Canada, Australia, and Chile; however, its funds are registered in Cayman Islands for tax purposes.[68]

There is limited publicly available information regarding Lighthouse, its subsidiaries (including Millennium), and its owner (Resource Capital Funds). All of these companies are privately held and are not subject to the requirements governing public companies, which have to disclose significant information to investors and government agencies (such as the US Securities and Exchange Commission (SEC)).[69]

There is somewhat more publicly available information regarding Lighthouse (then known as Ambre Energy North America) for the period (2014 and prior) when it was owned by Ambre Energy, an Australian public company. Ambre Energy had to disclose significant information to investors and the Australian Securities & Investment Commission.

Also, as explained in Section 5.6, when Ambre/Lighthouse acquired shares in the Millennium Project and coal mines from US public companies, these companies had to disclose significant information to investors, the SEC, and in the context of bankruptcy proceedings.

5.4 Lighthouse Complaint Claims: Decker and Black Butte Mines

The Lighthouse Complaint in federal litigation claims that its mining properties can supply large volumes of coal to Asian markets, where this coal (specifically from the Decker mine) is in high demand:

> 37. Since 2011, Lighthouse subsidiary LHR Coal has owned and leased coal mining rights, maintained coal loading infrastructure, and operated coal mines in Montana and Wyoming through its own subsidiary companies. <u>These mining properties were acquired primarily to meet current and projected demand from Asian customers</u>.
>
> 38. Under federal regulations, LHR Coal's subsidiaries are obligated to seek the maximum economic recovery for minerals mined on federal lands. <u>Lighthouse's efforts to export coal to Asia are part of its effort to seek maximum economic recovery</u>.
>
> 39. One of LHR Coal's subsidiaries owns and operates the Decker Coal Mine in southern Montana. The Decker mine […] has been in operation since the early 1970s […]
>
> 41. <u>Coal from the Decker mine is in high demand from overseas customers</u>. Reserves at Decker are approximately 241 million tons, with additional resources estimated at over 1.2 billion tons.
>
> 42. Another one of LHR Coal's subsidiaries owns a 50% interest in, and operates, the Black Butte mine in Wyoming. The Black Butte mine, […] has been in operation since the 1970s […]
>
> 44. LHR Coal's subsidiary Big Horn Coal Company also has rights to approximately 40 million tons of recoverable coal leased from the State of Wyoming.[70]

5.5 TGG Response: Decker and Black Butte are Small Older Low-Value Mines

5.5.1 Introduction

This section provides TGG's response to the Lighthouse Complaint claims regarding the Decker and Black Butte mines (¶¶ 37, 38, 41), as well as Big Horn Coal Company (¶

44). Lighthouse is claiming that its mining properties can supply large volumes of coal to Asian markets, where this coal (specifically from the Decker mine) is in high demand. Through the section, TGG responds to these claims by demonstrating that Decker and Black Butte are both small, older and low-value mines with high liabilities (particularly with respect to their reclamation requirements). Furthermore, there is no meaningful nexus between the Black Butte mine, or the coal deposits at Big Horn, and exports via Millennium. Hence, there is no meaningful nexus between these assets and Washington State's permit denials for the Project.

The following points summarize TGG's response:

- The production profiles of both mines reflect that these are older mines where the economically viable coal resources are depleted and the remaining resources have substantially higher production costs than costs at competing mines. (Section 5.5.2)

- Analysis by Level 3, a previous owner of the mines, emphasizes that they are high-cost and low value compared with competing mines and had structural disadvantages and production costs as much as four-to-five times higher than their competitors. (Section 5.5.3)

- The analysis by Level 3 is confirmed and expanded on by industry expert John T Boyd in comprehensive analyses of PRB coal production and markets. The Boyd 2011 analysis concluded that the Decker mine is nearly depleted, has structural disadvantages and production costs substantially higher than competing mines. Boyd concluded that Decker was likely to shut down soon after a limited amount of additional production. (Section 5.5.4)

- Older mines have sizable mine closure costs, including reclamation requirements that can discourage the closure of economically marginal mines. Due to these costs, it may cost more in the short-term to close a mine than to continue operating even if production is unprofitable. AENA confirmed that closing Decker would be significantly more expensive than continuing operations due to the reclamation costs. The Boyd 2017 analysis confirmed that Decker has a reclamation liability of about $132M, which is higher than competitors with greater reserves. Boyd further concludes that an ongoing high level of exports would require large capital expenditures that are neither likely (nor even feasible) given the limited resources and capital spending now prevalent in the coal industry. (Section 5.5.5)

- Black Butte has a niche market supplying a nearby power plant. The mine has limited domestic markets and the power plant is its only current market. The mine is not being used for exports. Contrary to what is implied in the Complaint, there is no meaningful nexus between the Black Butte mine and the denial of the permits in regard to the Millennium Project. (Section 5.5.6)

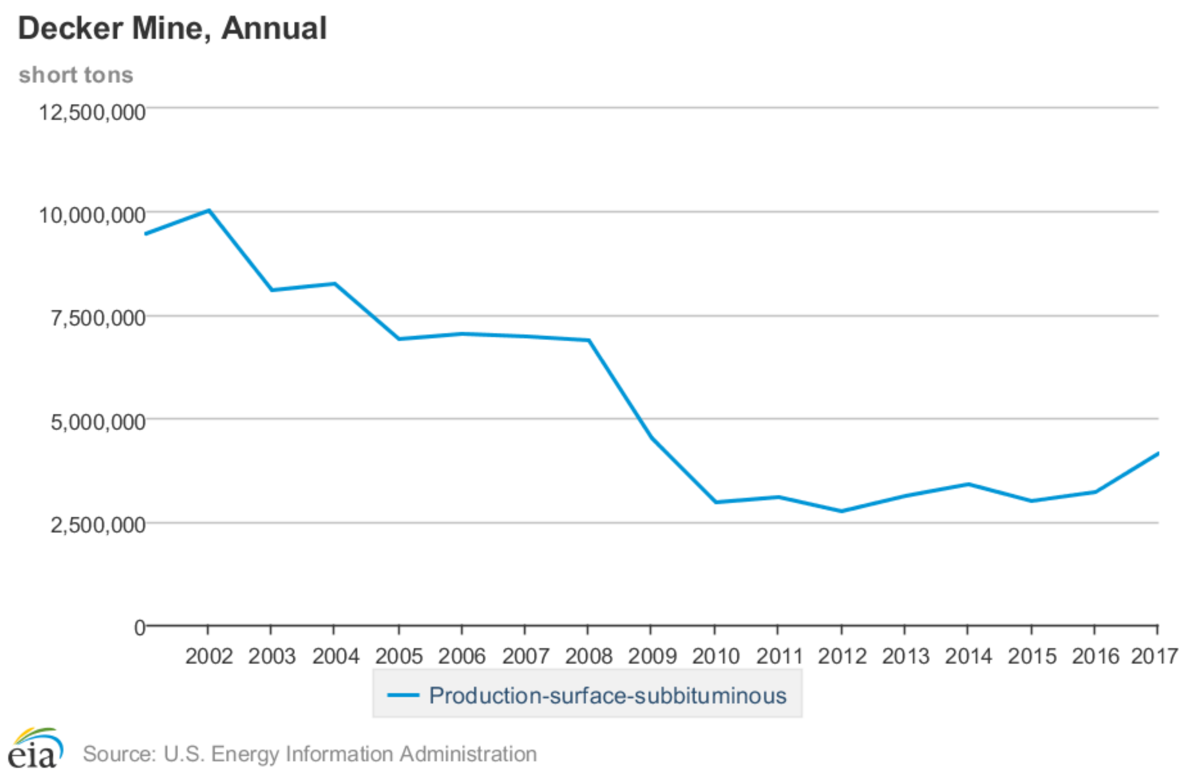
- Big Horn is an abandoned PRB mine that has been fully reclaimed. It is very unlikely that mining would resume there. Contrary to what is implied in the Complaint, there is no meaningful nexus between the coal deposits at Big Horn and the denial of the permits in regard to the Millennium Project. (Section 5.5.7)

5.5.2 Production History and Overview

As shown in Figure 9, Decker Mine production was 2.9 MMTPY (3.2 MMst) in 2016 and 3.8 MMTPY (4.2 MMst) in 2017. Decker production is somewhat variable year-to-year, but has been overall roughly flat since 2010 (averaging around 3.0 MMTPY (3.2 MMst)). Production in recent years is substantially below the volumes in 2001-2008 (around 6 to 9 MMTPY (7 to 10 MMst)). Production in 2017 is down by about two-thirds from the from the high of 12 MMTPY (13 MMst) in the late 1970s.[71]

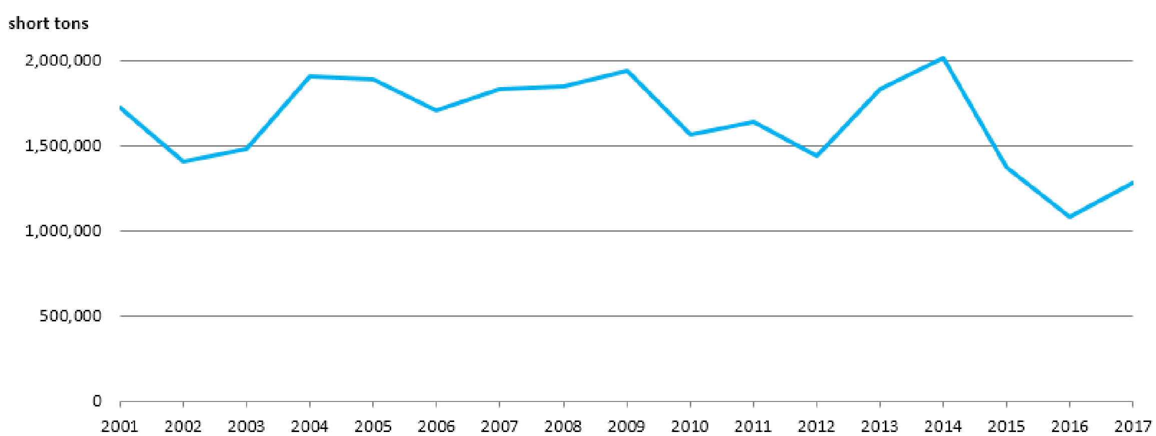
As shown in Figure 10, Black Butte Mine production (for Lighthouse’s 50% ownership share) was 1.0 MMTPY (1.1 MMst) in 2016 and 1.2 MMTPY (1.3 MMst) in 2017. Production in 2016 and 2017 was lower than in 2015 (1.2 MMTPY (1.4 MMst)) and substantially below prior volumes, which had been relatively flat (averaging around 1.6 MMTPY (1.7 MMst)).

Figure 9: Decker Mine: Annual Coal Production (2001-2017)



Source: EIA Coal Data Browser.[72]

Figure 10: Black Butte Mine: Annual Coal Production (2001-2017, 50% Ownership Share)



Source: EIA Coal Data Browser.[73]

As further explained in the current Section 5.5 and in 5.6,[74] the production profiles for Decker and Black Butte reflect that these are older mines where the economically viable coal resources are depleted. The lower cost, more economically viable resources have already been produced, and the remaining resources have production costs which are substantially higher than costs at competing mines.

Moreover, as also further explained in the current Section 5.5 and in 5.6,[75] older mines have sizable liabilities for retirement of assets (coal mine reclamation) and sometimes for employees (pension and medical obligations for retirees who worked at the mines). Hence, older mines can have a net value (assets minus liabilities) that is very low or even negative.

5.5.3 Analysis by Previous Owner (Level 3 Communications)

As further explained in Section 5.6.2, Lighthouse (then known as Ambre Energy North America) first became a US coal producer in 2011 by acquiring the 50% shares of the Decker and Black Butte Mines owned by KCP, a subsidiary of Level 3 Communications.

Level 3 Communications was a US public company, required to disclose significant information to investors and the SEC. Prior to divesting its ownership of the Decker and Black Butte Mines to Lighthouse, Level 3 emphasized that these mines were high cost and low-value; compared with competing mines (particularly in the Wyoming Powder River Basin), Decker and Black Butte had production costs as much as four and five times greater and were also disadvantaged owing to limited rail service and higher transportation costs:

> KCP's sales of its coal, like sales by other western coal producers, typically provide for delivery to customers at the mine. A significant portion of the customer's delivered cost of coal is attributable to transportation costs. The Decker and Black Butte mines are each served by a single railroad. Many of their western coal competitors are served by two railroads and such competitors' customers often benefit from lower transportation costs because of competition between railroads for coal hauling business. <u>Other western coal producers, particularly those in the Powder River Basin of Wyoming, have lower stripping ratios (that is, the amount of overburden that must be removed in proportion to the amount of minable coal) than the Black Butte and Decker mines, often resulting in lower comparative costs of production</u>. As a result, KCP's <u>production costs per ton of coal at the Black Butte and Decker mines can be as much as</u>

> <u>four and five times greater than production costs of certain competitors</u>. Because of these cost disadvantages, there is no assurance that KCP will be able to enter into additional long-term coal purchase contracts for Black Butte and Decker production. In addition, these cost disadvantages may adversely affect KCP's ability to compete for sales in the future.[76]

As explained by Level 3, the Decker and Black Butte Mines are structurally disadvantaged in regard to geology. Production costs are high because of high strip ratios; a large amount of overburden must be removed in proportion to the amount of minable coal.

5.5.4 John T. Boyd Powder River Basin Study (2011)

As described in Section 5.5.3, Level 3 clearly disclosed that the Decker and Black Butte Mines are structurally disadvantaged by high production costs and high strip ratios.

This analysis by Level 3 (former owner of these mines) is confirmed and elaborated upon in comprehensive analyses of PRB coal production and markets by John T. Boyd Company.[77] In 2011, Boyd provided a Powder River Basin Coal Resource and Cost Study on behalf of Xcel Energy.[78]

Xcel Energy is a regulated electric utility that has been a large customer for PRB coal, but is rapidly shifting to a cleaner energy mix.[79] Generation from coal is dropping from 56% of the total in 2005 to 37% in 2017 and 27% in 2022, while renewables (wind, solar, and other renewables) increase from 9% in 2005 to 26% in 2017 and 48% in 2022.

The Boyd 2011 Powder River Basin Study was submitted by Xcel in regulatory proceedings and is thus publicly available.[80] This study has been widely relied upon, including in US EIA Coal Market modeling[81] and the Tongue River Railroad EIS.[82] As further discussed in Section 5.5.5, John T. Boyd issued a new Powder River Basin study in 2017.[83]

The Boyd 2011 analysis concludes that the Decker Mine is nearly depleted and has strip ratios and production costs substantially higher than at competing mines; Decker is likely to shut down soon after a limited amount of additional production.

> The Decker Mine is jointly-owned by Level 3 Communications and Cloud Peak Energy Resources LLC, and operated by Kiewit Mining Group Inc.[84] <u>Mine production has declined in recent years as long-term sales contracts</u>

have expired and economically viable coal resources have depleted. In 2010 the Decker Mine produced 3.0 million tons of coal, down from the high of 13.0 million tons per year in the late 1970s.

The Decker Mine contains extensive coal resources at higher strip ratios – around 5.0 to 6.0+ BCY/ton. Other mines in the PRB generally will not reach that strip ratio range for approximately 25 to 30 years, thus, we expect Decker will close in the near future, and not reopen within the time horizon of this study.

[…]

The Decker Mine produces a 9,500 Btu/Lb coal product which is favorable from a transportation perspective. There may be a few niche markets for this coal in the near term, but over the longer term we believe the Decker Mine will not be economically viable. We have projected the mine will be idled or closed around 2014.[85]

[…]

Decker Mine […] is nearly depleted. […] The forecast assumes Decker operates through 2014 and then is phased out. Decker would not have a material influence on markets in any event.[86]

The Boyd 2011 Study estimated that production cost for Decker ($15.39/ton) was much higher than other PRB mines (averaging about $10 ton and generally ranging from $7-11$/ton).[87]

The Boyd 2011 Study evaluated the coal resources available at each PRB mine (and possible new mines) to determine the potential for future production that could be economically competitive within a 30-year timeframe. Even after many years of large production, there is still an enormous amount of coal remaining in the Powder River Basin. But only some of this coal is potentially competitive to produce, and actual production will be limited by market demand.

The Boyd 2011 Study concludes that potentially competitive coal resources are overall large at PRB mines, but extremely small at the Decker Mine.[88] There is a large amount of coal remaining at Decker. But it is not economically competitive to produce that coal, which has higher strip ratios and high production costs, compared with other PRB mines. As noted in this section and further explained in Section 6.3.2.4, permitting of the Tongue River Railroad included preparation of a federal EIS. The analysis of coal production and markets in the EIS also concluded that the Decker Mine was likely to close in the near future.[89]

5.5.5 Mine Reclamation and John T. Boyd Powder River Basin Study (2017)

Mine closure costs, including reclamation requirements, can discourage closure of economically marginal mines.

Coal mines have sizable reclamation costs; US coal mines must undertake reclamation and provide financial assurance for this reclamation.[90] Reclamation costs occur after production is halted (some or all of the mine is closed); however, some reclamation activities may occur earlier, while production is still ongoing, especially later in the mine's life. As a mine is operated and coal is extracted, the net present value decreases and can be negative (especially in later years):

- remaining coal reserves (tons) and value ($) decrease;
- requirements for subsequent reclamation ($) increase;
- time remaining before reclamation expenses (years) decrease;
- present value of reclamation expenses ($) increase.

Owing to reclamation and other costs relating to mine closure, it may cost more in the short-term to close a mine than to continue operating, even if ongoing production is unprofitable.[91] Hence, mines that are economically marginal (notably those with higher cost and/or lower revenue per ton) may not be closed, even in industry downturns (when revenues are depressed and production unprofitable).

As further discussed in Section 5.6.3.4, Ambre itself confirmed that closing Decker would be significantly more expensive than continuation of mining, due to the cost of reclamation:

> Due to the cost of reclaiming the land comprising the Decker Mine, closing the Decker Mine would be significantly more expensive […] than would the continuation of mining activity.[92]

The 2017 John T. Boyd Study notes that PRB mines now have a total reclamation liability exceeding $2.2 billion, which discourages mine closures.[93] The Decker Mine has a particularly large liability relative to current production and remaining reserves. The Decker reclamation liability (about $132 million) comprises about 6% of the overall PRB liability, but Decker production (3.2 MMst in 2016) comprises only about 1% of overall PRB production (313.7 MMst in 2016). And as estimated by Boyd, the coal resource at

Decker would enable only 4 more years of production (based on 2015 levels of output); other PRB mines are estimated to have substantially greater coal resources enabling more years of future output.

In this context, it is useful to compare Decker with Cloud Peak Energy's Spring Creek Mine. Spring Creek is located in the Montana Powder River Basin, near Decker. It produces a similar coal, and has similar markets, both domestically and more recently for exports to Asia. Spring Creek also has a relatively high reclamation liability, but less so than Decker Mine. The Spring Creek reclamation liability (about $120 million) comprises about 5% of the overall PRB liability, and Spring Creek (10.2 MMst production in 2016) comprises about 3% of overall PRB production. And as estimated by Boyd, the coal resource at Spring Creek would enable about 15 more years of production (based on 2015 levels of output).

As also explained in the 2017 Boyd Study, PRB mine owners are faced with difficult economic challenges and limited options. Mine closure would have high costs for reclamation. But to enable continued operations at high output levels, some mines may need to lease additional reserves, which could also have very high upfront costs. In this context, mine owners may reduce annual production and push these difficult decisions into the future.

The above information and analysis (from the 2017 John T. Boyd Study) also indicate that an ongoing high level of exports via Millennium may be difficult to achieve absent an unlikely scenario of ongoing high export market prices and strong profitability for coal producers. A lower level of exports may be achievable without large capital expenditures, using existing ports, infrastructure, and mining operations. But an ongoing high level of exports would require large capital expenditures that may not be likely or even feasible given the limited resources, capital expenditures, and profitability now prevalent in the coal industry (especially in the Power River Basin).

Capital expenditures to maintain and expand US coal production, which have previously been large, are now being limited to very low levels. As explained in Section 6, much of the US coal industry (especially in the Powder River Basin) is recently or currently in bankruptcy proceedings. These bankruptcies were subsequent to previous large commitments of resources for activities that were high-risk and speculative, notably for potential exports to Asia. Likewise, construction of the Millennium Project and producing large volumes of coal for export would require a large commitment of resources for activities that are high-risk and speculative.

5.5.6 Black Butte Mine: No Nexus with Exports and Millennium

There is no meaningful nexus between the Black Butte mine and exports via Millennium. Hence, there is no meaningful nexus between this asset and Washington State's permit denials for the Project. As confirmed by multiple sources, the Black Butte Mine is not being used for exports; Black Butte is supplying domestic US markets and specifically the nearby Jim Bridger power plant.

As explained in Sections 5.3 and 5.6.4, Lighthouse was previously known as Ambre Energy North America (AENA), a subsidiary of its Australian parent company, Ambre Energy Limited (AEL). AENA was financed and acquired by Resource Capital Funds (RCF) via a series of transactions from 2011 to 2014. As part of the transactions approved in December 2013, AEL retained an independent expert (BDO) to value AENA assets.[94]

In valuing the Black Butte Mine, BDO assumed that Black Butte coal production would all be sold to the US domestic market and that the value of Black Butte was not impacted by development of the Millennium project. Put more simply, BDO concluded that the value of Black Butte would be the same regardless of whether the Millennium Project was completed:

> […] <u>all coal produced at the Black Butte mine over the forecast period is assumed to be sold into the US domestic market. As none of the coal produced at the Black Butte mine is assumed to be exported, the value of the Black Butte mine is not impacted by</u> the material uncertainty which exists in relation to <u>the proposed development of the Port Assets</u>.
>
> […] the value of the Black Butte mine [is] unaffected by whether AEL is able to successfully complete the proposed development of the Port Assets.[95]

Black Butte is a small, older mine with limited economically viable resources and production costs substantially higher than the costs at competing mines.[96]

But Black Butte does have a niche supplying US domestic markets, and specifically the nearby Jim Bridger power plant.[97] Coal from Black Butte Mine is competitive in this niche market, owing to a combination of niche-specific factors favorable for Black Butte:

- low transport costs (Black Butte Mine supplies coal to Jim Bridger via a 20-mile railroad connection); and
- limited alternatives for Jim Bridger coal supply:

- other Jim Bridger coal supply from captive (on-site) mine, providing limited (and likely high cost) supply; and
- retrofits needed at Jim Bridger to use lower-cost coal supply from PRB mines.

Black Butte has had limited domestic markets, and the Jim Bridger power plant is now its only market.[98] **The Black Butte Mine is not being used for exports. Contrary to what is implied in the Complaint, there is no meaningful nexus between the Black Butte Mine and Washington State's permit denials for the Project.**

5.5.7 Big Horn Coal has Zero Value

Lighthouse (Complaint ¶44) claims that its coal supply chain includes approximately 40 million tons of recoverable coal at Big Horn in Wyoming.

As shown on Figure 6, Big Horn is a former ("abandoned") coal mine in the Wyoming Powder River Basin (in the northwest portion near Montana and the Lighthouse Decker and Cloud Peak Spring Creek Mines). Lighthouse acquired Big Horn (and Rosebud, another former coal mine) from Level 3 Communications, together with 50% ownership in the Decker and Black Butte Mines.[99] Production has ended at the Big Horn and Rosebud Mines, and they have been fully reclaimed.

As explained in Section 5.5.6, an independent expert (BDO) valued the assets of Ambre Energy North American (now known as Lighthouse) in 2013. BDO assigned a zero value to the Big Horn coal deposits (and to deposits at the former Rosebud Mine):

> We note the Rosebud and Big Horn deposits are not operated as at the date of this Report and are unlikely to be in operated in the immediate future. Given the significant risks and uncertainties associated with realising any value from the Rosebud and Big Horn deposits, we are of the view that their value is nominal and not material to the opinions contained within this Report.[100]

It is very unlikely that mining would resume at Big Horn. The remaining coal there has no significant economic value. Contrary to what is implied in the Complaint, there is no meaningful nexus between the coal deposits at Big Horn and exports via Millennium. Hence, there is no meaningful nexus between this asset and Washington State's permit denials for the Project.

5.6 Millennium and Lighthouse: History Demonstrates Low-Value and High-Risk

5.6.1 Introduction

This section describes how Lighthouse assembled a set of low-value distressed assets through a series of transactions, which involved very little, if any, direct compensation. Similarly, RCF gained control of Lighthouse through a series of transactions, which involved very little, if any, direct compensation. The history of Millennium and Lighthouse is a series of transactions demonstrating low-value and high-risk. In fact, the transactions demonstrate that there is little if any net value for Lighthouse and/or its assets. Below is a summary of this series of transactions. They will be described in greater detail throughout the current section.

Ambre Energy North America (AENA, now known as Lighthouse) first became a US coal producer in November 2011. AENA acquired 50% shares of the Decker and Black Butte Mines from Level 3 Communications. The direct compensation provided was minimal (less than $5 million). Level 3 estimated that these mines had a negative net value of $67 million. Liabilities (notably for mine reclamation) exceeded assets and were transferred to Ambre. (Section 5.6.2).

In September 2014, AENA acquired the remaining 50% share of the Decker mine from Cloud Peak Energy for zero direct compensation. Cloud Peak estimated that its 50% share of Decker had a negative net value of $69 million. Liabilities (notably for mine reclamation) exceeded assets and were transferred to Ambre. Ambre also gave Cloud Peak a Millennium throughput option, estimated by Cloud Peak to have zero value.

AENA's acquisition of Decker from Cloud Peak was subsequent to litigation. Cloud Peak had challenged Ambre's actions, which resulted in continuation and potential expansion of Decker production, instead of the near-term closure and reclamation previously planned (Section 5.6.3).

Also in 2014, RCF acquired AENA for minimal compensation (about $1 million). At the time of this acquisition, AENA owned 62% of Millennium, 100% of Decker, and 50% of Black Butte. In the face of a sharply deteriorating thermal coal market, Ambre's operations resulted in large losses, and Ambre's financial problems continued to intensify. RCF was the only available option for financing, and RCF acquired AENA via transactions that were distress sales (Section 5.6.4).

In 2016, AENA acquired the remaining 38% share of Millennium from Arch Coal for zero direct compensation. Ambre gave Arch a Millennium throughput option, estimated by Arch to have zero value. (Section 5.6.5).

RCF is a private equity firm specializing in high-risk mining-sector investments. RCF's extensive involvement is further indication that Millennium and Lighthouse are high-risk and have few (if any) other options for financing (Section 5.6.6).

As explained in Section 5.6.2 and 5.6.3, AENA acquired ownership of coal mines (100% of Decker and 50% of Black Butte) for minimal (if any) direct compensation. The value provided to sellers was that sizable liabilities (notably for mine reclamation) were transferred from the sellers to Ambre.

Likewise, as explained in Section 5.6.4 and 5.6.5, RCF's acquisition of AENA and AENA's acquisition of the other 38% share of Millennium share were distress sales. The value to the sellers was divesting liabilities and requirements for ongoing capital contributions.

5.6.2 Ambre/Lighthouse Acquired 50% of Decker and Black Butte Mines in 2011

Ambre Energy North America (AENA, now known as Lighthouse) first became a US coal producer in November 2011.[101] At the time, AENA acquired the 50% shares of the Decker and Black Butte thermal coal mines in Montana and Wyoming owned by KCP (formerly known as Kiewit Coal Properties and subsidiary of Level 3 Communications). This acquisition was partly financed through an equity investment in Ambre Energy by Resource Capital Funds (RCF), then Ambre's second largest shareholder.

AENA acquired shares in these two mines for less than $5 million in direct compensation. As explained in Sections 5.5 and 5.6, Decker and Black Butte are small, older mines, which are substantially higher cost than other mines, and particularly those in the Powder River Basin. And as explained below, **Level 3 estimated that the mine shares sold to Ambre had a negative net value: liabilities (notably for mine reclamation) exceeded assets by $67 million.**

The transactions between AENA and Level 3 were somewhat complex, and a variety of information about these transactions has been provided by AENA and Level 3 (notably in disclosures to investors required in Australia and US).[102] The direct compensation provided was less than $5 million.[103]

In addition to the direct compensation (less than $5 million), Ambre assumed Level 3's large long-term liabilities for retirement of assets (coal mine reclamation) and employees (pension and medical obligations for retirees who had worked at Level 3's mines). Level 3 financial statements value the mine reclamation liabilities transferred to Ambre at $105 million.[104]

Level 3 financial statements value the sale to Ambre as an approximately $72 million gain.[105] Less than $5 million of this was direct compensation; the remaining $67 million gain stems from shedding of liabilities that exceeded assets. Hence, **Level 3 financial accounting estimates that the mines sold to Ambre had a net value of negative $67 million; mine reclamation and other liabilities were much greater than assets**.

Prior to the 2011 sale to Ambre, Level 3's coal business had been in substantial long-term decline.[106] Coal production and sales revenue were dropping, especially at the Decker Mine. Earnings were minimal (or negative), and asset retirement liabilities (notably for mine reclamation) were continuing to increase with ongoing production.

Prior to the 2011 sale to Ambre, the plan for the Decker Mine was near-term closure and transition to full final reclamation (notably at the end of 2013, when Decker's one remaining coal sales contract (with a domestic customer) expired).[107]

5.6.3 Ambre/Lighthouse Acquired Remaining 50% of Decker Mine in 2014

5.6.3.1 Overview

In September 2014, AENA acquired the remaining 50% share of the Decker mine from Cloud Peak Energy for zero direct compensation. Cloud Peak estimated that its 50% share of Decker had a negative net value of $69 million. Liabilities (notably for mine reclamation) exceeded assets and were transferred to Ambre (Section 5.6.3.2).

Ambre also gave Cloud Peak a Millennium throughput option, estimated by Cloud Peak to have zero value (Section 5.6.3.3).

AENA's acquisition of Decker from Cloud Peak was resolution of litigation. Cloud Peak had challenged Ambre's actions, which resulted in continuation and potential expansion of Decker production, instead of the near-term closure and reclamation previously planned. To resolve this litigation, it was agreed in December 2012 that Ambre would acquire Cloud Peak's Decker share and assume all reclamation liabilities (Section 5.6.3.4).

5.6.3.2 50% of Decker Mine has Negative Net Value ($69 Million)

As explained above, AENA acquired Cloud Peak's 50% Decker Mine share for zero direct compensation.[108]

Ambre assumed Cloud Peak's large long-term liabilities for retirement of assets (coal mine reclamation), as well as for employees (pension obligations for retirees who had worked at the Decker mine). Cloud Peak financial statements value the mine reclamation liabilities transferred to Ambre at $72 million. As part of assuming these liabilities, Ambre fully replaced $66.7 million in reclamation and lease bonds that Cloud Peak had been required to provide as financial assurance.

Cloud Peak financial statements value the Decker divestiture to Ambre as an approximately $69 million net gain. None of this was direct compensation; all of the $69 million gain stems from shedding of liabilities that exceeded assets. Hence, **Cloud Peak financial accounting estimates that the 50% Decker share divested to Ambre had a net value of negative $69 million; mine reclamation and other liabilities were much greater than assets**.

Prior to the 2014 divestiture to Ambre, the Decker Mine had been in substantial long decline. In the three years leading up to divestiture (2012-2014), costs exceeded revenues and Cloud Peak had over $17 million in losses for its 50% share of Decker.

5.6.3.3 Millennium Throughput Option has Zero Value

As part of the Decker Mine acquisition in 2014, Ambre also gave Cloud Peak a Millennium throughput option, estimated by Cloud Peak to have zero value.[109]

Information regarding Cloud Peak's Millennium throughput option and other export terminal capacity is summarized in this section; see Section 6.4.3 for additional information.

Cloud Peak's Millennium throughput option covers up to a total of 7 MMTPY of capacity at Millennium and would have an initial term of 10 years, with four renewal options for five-year terms.

In its 2014 financial accounting for the Decker Mine divestiture to Ambre, Cloud Peak estimated that the Millennium throughput option had a value of $5 million. Hence, in its 2014 financial accounting, Cloud Peak valued the Decker divestiture to Ambre as an approximately $74 million gain: $69 million for divestiture of Decker (which had a negative net value, as explained in Section 5.6.3.2), plus $5 million for the Millennium throughput option.

But then in its 2015 financial accounting (and subsequently), Cloud Peak estimated that the <u>Millennium throughput option had zero value</u>. The shift to a zero valuation for Millennium was part of a broader reconsideration by Cloud Peak regarding the value of export terminal capacity.

As explained in Section 6.4 (as well as Sections 5.5.4 and 5.5.5), Cloud Peak is the coal producer that has been the largest exporter from the Powder River Basin, notably from its Spring Creek Mine. Cloud Peak is also a much larger overall coal producer than Lighthouse (even after the 2014 divestiture of the 50% Decker share to Lighthouse). By itself, Cloud Peak's Spring Creek Mine produces about twice as much coal as both of Lighthouse's mines (Decker and half of Black Butte), combined.

Leading up to 2015, as part of a concerted strategy to develop exports of Powder River Basin thermal coal, Cloud Peak:

- in 2013, entered into a throughput option agreement at the proposed coal and other dry bulk cargo Gateway Pacific Terminal in Cherry Point, Washington;
- in 2015, also became an 49% equity investor (together with the Crow Tribe) at Gateway Pacific;
- in 2014, paid $37 million to secure additional terminal capacity at Westshore in BC.

Then in 2015, Cloud Peak reduced to zero value its throughput options at Millennium and Gateway Pacific, as well as its contracted capacity at Westshore, which had been valued at over $52 million. Cloud Peak also fully impaired (reduced to a zero value) its $6 million equity investment in Gateway Pacific. Taken together, in 2015, Cloud Peak wrote off about $58 million in relation to export terminal capacity.

Cloud Peak disclosed that these large write-offs were in consideration of weak export market conditions, including:

- consensus projections of weak export pricing;
- a weak outlook for coal exports; and
- Cloud Peak's associated decision to amend port and rail contracts to require no export shipments from 2016 through 2018.

5.6.3.4 Litigation between Ambre/Lighthouse and Cloud Peak

AENA's acquisition of Decker from Cloud Peak was subsequent to litigation ("Decker Litigation").[110] As explained in Section 5.6.2, AENA acquired a 50% share of the Decker Mine from Level 3 in November 2011. In July 2012, Cloud Peak filed a lawsuit challenging Ambre's actions, which resulted in continuation and potential expansion of Decker production, instead of the near-term closure and reclamation previously planned. To resolve this litigation, it was agreed in December 2012 that Ambre would acquire Cloud Peak's Decker share and assume all reclamation liabilities. At that time, it was expected that the acquisition would be completed in early 2013.

To complete the acquisition from Cloud Peak, Ambre had to secure financing and provide financial assurance for Decker's reclamation liabilities (totaling about $70 million at time of actual acquisition in 2014). But as further explained in Section 5.6.4, Ambre had severe ongoing financial difficulties during this period, such that it was unable to secure required financing and complete the acquisition until September 2014 (two years later).

The Decker litigation provides substantial additional confirmation that the Decker Mine and Lighthouse are low-value and high-risk. Moreover, the actions and claims of Lighthouse (then known as AENA) in 2011-2014 are substantially similar to the more recent actions and claims of Lighthouse, and specifically the claims made by Lighthouse (as Plaintiff) in the current 2018 Complaint in federal litigation. These actions and claims were challenged by Cloud Peak in the Decker litigation. Hence, Cloud Peak's Complaint in that earlier litigation provides a useful response to similar claims made by Lighthouse in the current Complaint. The following points summarize Cloud Peak's position in the Decker Litigation (bold added for emphasis):

- Decker had previously been operated by Level 3; with the 2011 acquisition, AENA became the operator; [111]
- Cloud Peak owns 50% of Decker and shares in the costs and risks, but Ambre (the operator) has responsibility for the day-to-day operations of the mine;
- **compared with competing mines, production costs are much higher at Decker**, which is also disadvantaged by limited rail service and higher transportation costs;
- the factors in these higher costs were clearly disclosed by the previous owner and operator (Level 3) (Section 5.5.3); [112]
- Decker production and sales declined from around 7 MMst (in the years up to 2008) to about 3 MMst (in the years from 2010 onward) (Section 5.5.2 and Figure 9 in this report);
- "[t]he historical downward coal […] tonnage trend is a product of the non-competitive nature of marketing coal from the Decker Mine"; [113]
- due to a combination of operational and economic reasons, the plan for the Decker Mine had been to cease all coal sales upon termination of the one

remaining contract (with a Michigan utility) and transition to full final reclamation of Decker at the end of 2013;

- Ambre (through its various entities) is seeking to redevelop Decker and expand production for planned future Asian exports;
- redeveloping Decker would require significant capital costs, with associated risk, for Cloud Peak as well as Ambre;
- continuation and potential expansion of Decker production would involve significant costs and risks related to future increased reclamation costs and liabilities, for Cloud Peak as well as Ambre;
- "the Ambre Entities seek to unilaterally force a significant change in the long-standing direction of the Decker Mine and its associated business and financial risks by redeveloping and expanding the mine for planned future Asian exports"; [114]
- "Ambre Entities' loosely defined export redevelopment proposal lacks basic information and transparency and is built upon a foundation of self-dealing among the Ambre Entities"; [115]
- risks to Cloud Peak "are increased by the potential financial instability of the Ambre Entities. […] according to Ambre Limited's own auditor, 'There exists significant uncertainty whether [the Ambre Entities] would be able to continue as a going concern' due to financial problems." [116]

5.6.4 RCF Acquired Ambre/Lighthouse in 2014

5.6.4.1 Overview

As indicated above, Lighthouse was previously known as Ambre Energy North America (AENA), a subsidiary of its Australian parent company, Ambre Energy Limited (AEL). AENA was financed and acquired by Resource Capital Funds (RCF) via a series of transactions from 2011 to 2014. The analysis in this report focuses on the late 2014 transaction (Section 5.6.4.2), but also provides some information and analysis regarding the late 2013 transaction (Section 5.6.4.3).

Through the period leading up to the 2013 and 2014 transactions, AEL (and AENA) were under severe and intensifying financial stress. In each financial report, AEL's auditor identified increasing losses and material uncertainty regarding whether AENA and its controlled entities (notably AENA) would be able to secure needed funding and continue as a going concern:

> for the year ended 30 June 2011 […] a loss of $23,129,300 […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern[117]

> for year ended 30 June 2012 […] a loss of $65,367,000 […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern[118]
>
> for the period 1 July 2012 to 31 December 2012 […] a loss of $32,0002,000 for the six month period, and current liabilities exceed current assets by $19,284,000 at period end. […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern[119]
>
> for the 12 month period ended 31 December 2013 […] a recorded loss for the period of $66,414,000 and net operating cash outflows of $28,328,000. **Prima facie, these conditions indicate a material uncertainty regarding the** […] **entity's ability to continue as a going concern.**[120]

As explained in Sections 5.6.3.2 and 5.6.3.4, the July 2012 Cloud Peak Complaint in Decker Litigation identified the non-competitive nature of the Decker Mine and increasing risks relating to Ambre's financial instability. Then, in the face of a sharply deteriorating thermal coal market, Ambre's operations resulted in large losses, and Ambre's financial problems continued to intensify. RCF was the only viable option for financing, and RCF acquired ANEA via transactions that were distress sales.

5.6.4.2 AENA had Minimal Value when Acquired in 2014 ($1 million)

In late 2014, Resource Capital Funds (RCF) acquired Ambre Energy North America (AENA, now Lighthouse) from Ambre Energy Limited (its Australian parent company).[121] RCF acquired AENA for minimal direct compensation (about $1 million). At the time of this acquisition, AENA owned 62% of Millennium, 100% of Decker, and 50% of Black Butte.[122]

This 2014 acquisition and previous transactions between RCF and AENA were complex. A variety of information about these transactions has been provided by AENA (notably in disclosures required in Australia).[123] The funds provided by RCF relating to the 2014 acquisition were:

- US$18 million, minus
- $16.5 million used to pay off a portion of ANEA liabilities,[124] and
- a portion of AENA costs incurred in connection with the transaction.

The net funds provided by RCF were less than $750,000.[125] The 2014 acquisition increased RCF's ownership share by about 66% (from 26% to 92%). RCF acquired

66% of AENA for less than $750,000. So on this basis, 100% of AENA was worth only about $1 million at the time of the transfer of ownership to RCF in 2014.[126]

The RCF acquisition was subject to approval by Ambre shareholders.[127] Ambre management justified the transaction (and its minimal valuation of AENA) explaining that in the face of sharply deteriorating thermal coal market conditions, RCF was the only available funding source; without RCF, AENA could not continue to operate, develop port projects and more generally implement its US coal export strategy:

> (a) Since deferring an initial public offering of the Company's shares on the Australian Securities Exchange planned for mid-2012, the Company has struggled, in the face of a sharply deteriorating thermal coal market, to raise the capital required to fund the operations of AENA, that is, the development of its US port projects, the optimization of its US coal mining assets, and the implementation generally of its US coal export strategy.
> (b) <u>During that time, the only source of capital the Company has been able to secure has been from its major shareholder, RCF</u> V. This is the case despite various attempts to raise equity and debt from third parties, and more recently, to raise cash by trying to sell individual assets that are not required for the Company's core business. All of these attempts have ultimately been unsuccessful.
> (c) […] thermal coal market conditions have continued to deteriorate as each new cash injection from RCF V has been exhausted.
> (d) In July 2014, as remaining cash reserves were once again being depleted, RCF V confirmed that it would not be able to provide any further funding to the Company.
> (e) The directors believe that in the current market, the Company will not be able to raise from other parties the additional capital needed to fund the operations of AENA while waiting for market conditions to improve.
> (f) The debts owing to RCF V under its most recent bridge loan and RCF VI in connection with repayment of the Korean Lenders will mature on 31 December 2014 and 28 February 2015 respectively.[128] <u>It is highly unlikely that AENA (or the Company) will be able to refinance or repay these debts on time. If AENA fails to repay these debts on time, this will trigger a default under AENA's other finance facilities, including the RCF Loan</u> […][129]

Put simply, Ambre management acknowledged that the RCF 2014 acquisition provided very little value to Ambre shareholders, but it should nonetheless be approved, since there were no other viable options enabling AENA to continue operating, developing port projects and US coal exports. Even a bad deal was deemed to be better than no deal and defaults on various loans. Ambre stockholders approved the RCF acquisition at the December 22, 2014 Annual General Meeting.

RCF's acquisition of AENA in 2014 was a distress sale. The value to the sellers was divesting debts and liabilities that could not be sustained.

5.6.4.3 RCF Partial Acquisition of Ambre in 2013 was Not Fair but Reasonable

RCF's acquisition of AENA in 2014 was not the first time that Ambre had agreed to a distress sale to RCF.[130] A year prior (at the December 4, 2013 Annual General Meeting), Ambre stockholders approved a partial acquisition of AEL (and thus AENA) by RCF. This transaction (via issuance of shares to RCF) was subject to the requirements of the Australian Securities & Investment Commission.

As part of the review and approval process for this transaction, Ambre was required to present shareholders with an Independent Expert's Report providing an assessment of whether the transaction was "**fair and reasonable**". Ambre retained BDO to review the proposed transaction, including valuing AENA assets.[131] In the specialized nomenclature of Australian financial regulation, BDO concluded that the proposed transaction with RCF was **"Not Fair"** but was "**Reasonable"** to the non-associated shareholders (i.e., the shareholders not associated with RCF).

BDO concluded that the proposed transaction was "**Not Fair"** because it was unfavorable to Ambre shareholders not associated with RCF. In effect, value was being transferred from Ambre to RCF. In other words, RCF was acquiring and gaining control of Ambre (and specifically AENA) at a discount price.

Nonetheless, BDO concluded that the proposed transaction with RCF was "**Reasonable**." In reaching this conclusion, BDO emphasized that the proposed transaction was the best proposal currently available and that Ambre would have difficulty obtaining alternative financing and avoiding defaults on various loans.

So as was also the case with the final 2014 acquisition of AENA by RCF, a bad deal with RCF was better than no deal, which could have resulted in defaults and an even greater loss of value for shareholders. Absent the deal with RCF, Ambre (and AENA) would <u>not</u> have been able to secure needed funding and would <u>not</u> be have been able to continue as a going concern.

5.6.5 Lighthouse Acquired Remaining 38% of Millennium from Arch in 2016

Lighthouse acquired remaining 38% of Millennium from Arch Coal in May 2016 for no direct compensation; Arch Coal had previously spent about $60 million for its share of Millennium.

As further explained in Section 6.3, Arch Coal is the second largest coal producer in the Powder River Basin and in all of US. In the period leading to its Chapter 11 bankruptcy in 2016, Arch spent (and lost) over $240 million as part of a concerted strategy to develop exports of PRB thermal coal to Asian markets. Millennium was a major part of this strategy and a major part of the resulting losses.

Arch Coal originally acquired a 38% share of Millennium in January 2011 for $25 million, plus additional compensation to be provided upon completion of certain project milestones:

> […] Arch […] has acquired an equity interest in Millennium Bulk Terminals-Longview, LLC ("MBT"), the owner of a bulk commodity terminal on the Columbia River near Longview, Wash., in exchange for $25 million plus additional consideration upon the completion of certain project milestones. Under terms of the agreement, <u>Arch will control 38 percent of the terminal's throughput and storage capacity to facilitate export shipments of coal off the western coast of the United States</u>. […]
>
> "<u>The West Coast export facility […] will help Arch to accomplish its strategic objective of expanding sales of Powder River Basin and Western Bituminous[132] coals into the Asia-Pacific region, the world's largest and fastest-growing coal market</u>," said Leer. "<u>Increasing our direct exposure to the growing seaborne thermal market should further unlock the value inherent in our western coal assets</u>."[133]

As a 38% owner of Millennium, Arch was subject to repeated capital calls, requiring Arch to contribute $34.5 million in addition to the $25 million original investment.[134] In the period up to May 2016, Arch had paid a total of $59.5 million for its 38% share of Millennium.

In May 2016, Lighthouse acquired 38% of Millennium from Arch Coal, which was then undergoing Chapter 11 Bankruptcy.[135] Arch received no monetary compensation for its 38% ownership share and the $59.5 million previously contributed. Nonetheless, this transfer was agreed to (by Arch debtors and the US Bankruptcy Judge) in order to relieve Arch of its obligations and liabilities in regard to Millennium. Put more simply, it was better for Arch to give a 38% share of Millennium to Lighthouse, to avoid Arch having to provide ongoing capital contributions.

These ongoing capital contributions were about $7 million per year pre-construction. But if Millennium had been permitted and built, Arch's share of estimated construction costs would have been around $260 million.[136]

As part of relinquishing its ownership in Millennium, Arch was given an option to use a portion of throughput at Millennium (when and if the facility is completed).[137] Specifically, Arch received an option to utilize up to 10% of the throughput capacity for a period of ten years, with the option to extend for two additional five-year terms, at a cost no less favorable than any other Millennium customer with a throughput contract with term business.

This throughput option is estimated to have no economic value in Arch financial accounting.[138] Likewise, a larger Millennium throughput option received by Cloud Peak Energy is estimated to have no economic value in its financial accounting.[139] Therefore, it is reasonable to assume that the throughput option received by Arch has essentially no economic value.

Likewise, based on Lighthouse acquiring 38% of Millennium from Arch for no direct compensation, it is reasonable to assume that in May 2016 the value of Arch's 38% share was essentially zero (and possibly negative, at least for any buyers other than Lighthouse). And given that the value of Arch's 38% share was essentially zero (and possibly negative) in May 2016, it is reasonable to estimate that Lighthouse's share of the Project (62% rising to 100%) also had essentially zero net value at that time. That said, Arch Coal was undergoing Chapter 11 bankruptcy, which could have affected its actions and options to divest its share of the Millennium Project. However, it is notable that Arch Coal was unable to sell its 38% share at a substantial price, either to Lighthouse or to other parties.[140]

5.6.6 Resource Capital Funds

RCF is a private equity firm specializing in high-risk mining-sector investments.[141] RCF's extensive involvement is further confirmation that Millennium and Lighthouse are high-risk and have few (if any) other options for financing.

It is unclear how much longer RCF will continue to be involved with Millennium and Lighthouse. RCF typically invests in companies for 4-7 years.[142] RCF initially invested in Ambre (now Lighthouse) in 2011.[143]

RCF typically invests in companies in amounts up to $300 million (or possibly up to $500 million with RCF acting as lead to multiple investors).[144] Even if this full amount of investment were available, it would not be sufficient to fund Project construction (estimated to cost $680 million). Lighthouse is now the sole owner of Millennium (after Arch transferred its 38% ownership share to Lighthouse in 2016, as discussed in Section 5.6.5). Moreover, while the total amount spent to date has not been publicly disclosed, the available information from various sources indicates that RCF has already expended substantial funds as part of its investment and ownership relating to Lighthouse. Meanwhile, aside from Millennium, Lighthouse's other assets (notably the Decker and Black Butte thermal coal mines in Montana and Wyoming) have little (and possibly negative) net value and contribution to cash flow.

So it is unclear if and how Millennium could pay for Project construction, and what risks could be involved. Likewise, it is unclear what if any other options there may be for Millennium and Lighthouse to obtain future financing, especially if and when RCF reduces or ends its involvement.

6 Potential Thermal Coal Exporters are Low-Value and High-Risk

6.1 Key Findings

Finding 1: All of the coal producers and exporters identified in this section with a significant potential nexus to the Project are low-value and high-risk. (Sections 6.3, 6.4 and 6.5).

Finding 2: The US coal industry is in a weak financial position. Arch Coal and Peabody, the two biggest US coal producers (and the two biggest coal producers in the PRB) entered into Chapter 11 bankruptcy in 2016. Another significant PRB coal producer, Alpha Natural Resources, entered into Chapter 11 bankruptcy in 2015. And in October 2018, Westmoreland, a major US and PRB coal producer also entered into Chapter 11 bankruptcy. (Section 6)

Finding 3: These bankruptcies were in no way the result of permit denials by State of Washington in regard to the Millennium Project. All bankruptcies besides that of Westmoreland predate the permit denials **by State of Washington in regard to the Millennium Project**. Westmoreland's PRB mines supply domestic markets, the decline of which is independent of and predates the permit denials. (Sections 6.3.2, 6.5.1, 6.5.2, 6.5.3)

Finding 4: Arch's strategy of developing infrastructure and mines to enable exports of PRB coal to Asia was a risky, long-term bet leading to Chapter 11 bankruptcy. Post-bankruptcy, thermal coal exports are a very small part of Arch operations and strategy, and Arch is not exporting PRB coal (Section 6.3)

Finding 5: These bankruptcies and the coal producers' actions post-bankruptcy (i.e. limiting PRB exports, relinquishing leases in the PRB, divestment and transfer of PRB mines) provide further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. (Sections 6.3 and 6.5)

Finding 6: Cloud Peak's decline in coal production and sales, together with its dramatic reduction in capital expenditures, is also further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options, which are intensifying. (Section 6.4.1)

Finding 7: The greatest challenge in the development of large new coal export terminals may be the weak financial situation of the US coal market and coal producers. (Section 6.2)

Finding 8: Compared with Lighthouse, CPE is a much larger coal producer and exporter, operating larger more competitive mines. Total market capitalization for CPE is now about $110 million. If CPE is worth $110 million, Lighthouse has much less value as a coal producer. Together with the analysis of Millennium and Lighthouse in Section 5, this comparison with CPE further confirms that Lighthouse is a very small coal producer with low (if any) value and high risk. (Section 6.4.1)

Finding 9: CPE has used existing ports and other infrastructure to export significant volumes of PRB coal when market conditions have sometimes been favorable in recent years. Put simply, even without the Project, Cloud Peak can and does export PRB thermal coal to Asia and in particular via the Westshore Terminal (in BC). CPE has confirmed that recent agreements with the Westshore Terminal (an existing lowest cost, Capesize port) provide Cloud Peak with firm export capacity foundation for many years. (Section 6.4.3)

The above Findings from this section are supportive of four of the seven overarching Key Findings of this report (Key Findings 1, 4, 5 and 6 from Section 1.1):

Key Finding 1: The Applicant (Lighthouse Resources, Inc.) is a minor player in the US thermal coal industry. (Section 6.4.1)

Key Finding 4: A number of other port alternatives exist that can meet the intermittent and shrinking Asian demand for US thermal coal exports. (Section 6.4.3)

Key Finding 5: US thermal coal exports face a number of economic challenges and structural disadvantages in the global markets, which are intensifying. These competitive challenges are unrelated to port capacity and will not be overcome by Millennium. (Section 6)

Key Finding 6: The denial of the permits has no significant effect on the US domestic coal industry. (Sections 6.3.2, 6.5.1, 6.5.2, 6.5.3)

6.2 Introduction: Coal Exporters with Nexus to Millennium

The focus in this section is on coal producers with significant potential nexus to the Millennium Project, as opposed to the entire US coal industry. As explained in Section 4.7, all (or almost all) of the coal that might be exported via the Project would come from PRB mines in Montana and Wyoming. Hence, the coal producers and exporters with significant potential nexus to the Millennium Project are those in the Powder River Basin in both Montana and Wyoming, and especially those in Montana.

Coal producers can, and often do, have nexus with export terminals in multiple ways. Notably, coal producers can:

- mine and sell the coal that is handled by export terminals;
- contract for port capacity and/or be customers of the terminals; and
- invest in and own terminals.

Given these multiple potential channels for nexus, the analysis in this report focuses on three coal producers and exporters that have particular nexus with Millennium:

- Lighthouse (Section 5);
- Arch Coal (Section 6.3); and
- Cloud Peak Energy (Section 6.4).

This report also provides a more limited analysis of other PRB coal producers and potential exporters, including Peabody, Westmoreland and Alpha/Contura/Blackjewel (Section 6.5).

The Complaint (footnote 16 to ¶77) relies on a 2015 study, The Impact of the Coal Economy on Wyoming, by the Centre for Energy Economics and Public Policy (CEE) at the University of Wyoming. As we noted in Section 10.5.4, the CEE Study was prepared on behalf of the Wyoming Infrastructure Authority, a group that is supportive of coal production and exports. The CEE study was cited by the Complaint in reference to the economic (including employment) benefits of Wyoming coal production. In our evaluation of Lighthouse's employment benefits claims, TGG extensively reviewed this industry-friendly source and used it as a starting point for our analysis of Wyoming job impacts of the Project. The CEE Study specifically analyzes job impacts of coal production in Wyoming for export to Asia via Pacific Northwest terminals.[145]

The development of large new coal export terminals often involves (and in practice may require) backing by large credit-worthy coal producers. The CEE study explains that the greatest challenge in the development of such terminals may be the weak financial situation of the US coal market and coal producers:

> In addition to environmental concerns, […] the greatest challenge in achieving […] port expansion may be the […] weakness of the coal market and domestic coal producers themselves.[146]
>
> […]
>
> the development of large-scale new port facilities in the United States may be affected by the weak financial condition of its primary backers – large coal companies. For example, Arch Coal, backing 38% of the proposed Millennium Bulk Terminal port expansion has experienced a sharp decline in its capital value, with market capitalization of less than $500 million while carrying $5.1 billion in long-term debt […]. In late November 2014, Ambre Energy, the majority backer of the Millennium Bulk Terminal project, announced in a regulatory filing that it was divesting of its North American coal export assets, selling them to a Denver-based private-equity firm.[147] [148] Further, Peabody Energy, owner of half of the proposed Gateway Pacific Terminal capacity is in weak financial condition, and Cloud Peak, with an interest in capacity at both terminals has recently admitted recent losses on coal exports, while divesting of export mine interests.[149] Weakness in US coal markets has left US firms in diminished financial positions, and their ability to finance large-scale investments that such facilities would require is uncertain, as is the general market willingness to back such projects.[150] [151]

It is notable (and prescient) that the CEE Study (released in February 2015) focused on the financial condition of the coal companies involved in Millennium and other major terminal projects (notably Gateway Pacific). At that time, Arch Coal and Peabody were in weak financial condition (as explained by the CEE Study). A year later, both of these large coal producers were in Chapter 11 Bankruptcy (as explained in Sections 4.8, 6.3.2.2 and 6.5). And since the CEE Study, other PRB coal producers have also been in Chapter 11 (as explained in Section 4.8 and 6.5).

In particular, as explained in a 2017 Congressional Research Report on the US coal industry, coal producers (including Arch and Peabody) have emerged from bankruptcy with reduced debt levels. However, it will be a challenge for the coal industry to finance new or expanded projects:

> Arch Coal, ANR, and Peabody Energy have emerged from Chapter 11 with a plan to move forward, selling off some holdings. […] A major challenge for the coal industry will be to attain access to financing needed for new or expanded projects, but following their reorganization and

reduced debt levels, the larger coal firms are generally expected to be in a better position to be profitable.[152]

In the period leading up to the bankruptcy for much of the coal industry (in the US and specifically PRB), there was large spending on projects to maintain and expand production, including infrastructure to enable PRB thermal coal exports. More recently (and post-bankruptcies), Arch and other coal producers are minimizing debt and capital spending, and focusing on higher margin metallurgical coal.

It is also notable (and prescient) that the CEE Study (released in February 2015) explained that "Ambre Energy […] was divesting of its North American coal export assets" to "a Denver-based private-equity firm." This is the acquisition of AENA (now known as Lighthouse) by RCF (as explained in Section 5.6.4). As noted in the CEE Study, Ambre was then the majority backer of the Millennium Project. Following acquisition of the remaining share of the Project from a bankrupt Arch in 2016, Lighthouse is sole backer of Millennium (as explained in Section 5.6.5).

Sole ownership of the Millennium Project by Lighthouse is a somewhat atypical structuring for a major export terminal. Typical owners (and operators) of export terminals and other energy logistics facilities include the following:

- energy producers;
- energy consumers;
- midstream companies specializing in energy logistics;
- some combination of the above.

Involvement by energy producers and consumers is common, and this has potential benefits in terms vertical integration. Involvement by midstream companies is common, and this has potential benefits in terms of scale, scope, specialization, and diversification across multiple locations and types of activities.

Lighthouse is a coal producer and exporter; developing Millennium may benefit Lighthouse in terms of vertical integration. But any such benefits will likely be quite limited, since Millennium is a very large terminal owned by a very small coal producer. As explained in Sections 4 and 5, Lighthouse is a very small, low-value, high-risk coal producer, whereas Millennium is a very large export terminal.

However, Lighthouse is not an established midstream company specializing in energy logistics, nor does it have any meaningful diversification. Lighthouse now has a single, very large project (Millennium), targeting a single narrow niche (exports of PRB thermal coal to Asia). Lighthouse also proposed two other terminal projects (Morrow in Oregon and Corpus Christi in Texas), also targeting the same niche (exports of PRB thermal coal to Asia) that have now been cancelled.

6.3 Arch Coal

6.3.1 Introduction

Arch Coal is the second largest producer of thermal coal in the US and in the Powder River Basin. Arch is also a leading metallurgical coal producer.

Arch's strategy of developing infrastructure and mines to enable exports of PRB coal to Asia was a risky, long-term bet leading to Chapter 11 bankruptcy. This strategy resulted in over $240 million in losses on infrastructure and mines that were not permitted and not built. But if these projects had proceeded to construction, Arch would have had to spend another $735 million, and possibly substantially more. (Section 6.3.2). Post-bankruptcy, exports of thermal coal are a very small part of Arch operations and strategy, and Arch is not exporting PRB coal (Section 6.3.3).

6.3.2 Millennium and Export Strategy were risky, long-term bets leading to Chapter 11 Bankruptcy

6.3.2.1 Overview

Arch's strategy of developing infrastructure and mines to enable exports of PRB coal to Asia resulted in over $240 million in losses[153] leading to Chapter 11 bankruptcy in 2016.[154] As explained in Sections 5.6.5, Arch was 38% owner of Millennium from 2011 to 2016, resulting in $60 million of these losses.

Arch spent over $240 million on infrastructure and mines that were not permitted and not built. But if these projects had proceeded to construction, Arch would have had to spend another $735 million (and possibly substantially more).[155]

In the years leading up to Chapter 11 bankruptcy, Arch struggled to manage high indebtedness. Nonetheless, Arch choose to continue devoting substantial time, capital and resources to a risky long-term export strategy. In mid-2013, when there were already concerns about possible bankruptcy, Arch provided this justification for its ongoing focus on exports, and specifically the Millennium Project:[156]

> the long-term opportunity of moving PRB tonnage into Asia creates a compelling value proposition for Arch. That's why we continue to pursue port opportunities off the West Coast.
>
> […] we expect a multiyear process to bring in BT [Millennium Bulk Terminal] online with many milestones to be reached along the way, but we're making progress. In the meantime, we are shipping limited volumes out of Ridley to develop a customer base for PRB, and we'll continue to pursue other options to expand our export opportunities for Western coals. […] a growing and vibrant export market for PRB should unlock further value for our assets and our company over time.
>
> […]
>
> <u>we've been more proactive than others in terms of going out and getting the infrastructure to allow us to access that demand growth we see around the world.</u>

Less than three years later, Arch was in Chapter 11 bankruptcy. Arch's strategy of developing infrastructure and mines to enable exports of PRB coal to Asia had resulted in over $240 million in losses. And if these projects had proceeded to construction, Arch would have had to spend another $735 million (and possibly substantially more).[157] Arch could no longer devote the time, capital and resources required for an export strategy that had proven to be low-value and high-risk.

6.3.2.2 Arch Coal Bankruptcy not due to Actions by State of Washington

The Arch Coal bankruptcy predates and was in no way the result of permit denials by State of Washington in regard to the Millennium Project. Arch Coal entered Chapter 11 Bankruptcy in January 2016 and exited in October 2016.[158] **The Millennium Project FEIS was issued in April 2017. Washington Department of Ecology issued its denial of Section 401 Certification for the Project on September 26, 2017.**

If there is any nexus between the Arch Coal bankruptcy and permitting of the Millennium Project, it is that Arch Coal would have been in an even worse position if the Millennium Project had proceeded more rapidly towards construction. As explained in Sections 5.6.5 and 6.3.2.3, Arch owned a 38% share of Millennium from January 2016 to May 2016 (about 5 years). During that period, Arch spent (and lost) about $60 million on Millennium. If Arch had retained its 38% share and Millennium had been permitted and built, Arch's share of estimated construction costs would have been around $260 million. Put simply, if the Millennium Project had moved more rapidly towards construction, Arch would have spent and lost even more than it actually did in the period leading up to and during bankruptcy.

6.3.2.3 Millennium and Ridley

As part of a concerted strategy to develop exports of PRB thermal coal to Asian markets, Arch Coal in January 2011:

- acquired a 38% share of Millennium; and
- contracted with Ridley Terminal in BC to export up to 2.5 MMTPY through 2015:

> **Strategic Investments**
>
> […]
>
> In recent developments, Arch announced that it has acquired an equity interest in Millennium Bulk Terminals-Longview, LLC ("MBT"), the owner of a bulk commodity terminal on the Columbia River near Longview, Wash., in exchange for $25 million plus additional consideration upon the completion of certain project milestones. Under terms of the agreement, <u>Arch will control 38 percent of the terminal's throughput and storage capacity to facilitate export shipments of coal off the western coast of the United States</u>. […]
>
> Arch also recently signed a five-year throughput agreement with Canadian Crown Corporation Ridley Terminals Inc. ("RTI") - a coal and other bulk commodity marine terminal located near Prince Rupert, British Columbia - to facilitate coal exports to Pacific Rim markets. The agreement grants Arch the ability to ship up to 2 million metric tons of coal through the RTI terminal for 2011, and up to 2.5 million metric tons of coal annually through RTI for 2012 through 2015.
>
> "<u>The West Coast export facility announcements will help Arch to accomplish its strategic objective of expanding sales of Powder River Basin and Western Bituminous[159] coals into the Asia-Pacific region, the world's largest and fastest-growing coal market</u>," said Leer. "<u>Increasing our direct exposure to the growing seaborne thermal market should further unlock the value inherent in our western coal assets</u>."[160]

As explained in Section 5.6.5, between 2011 to 2016, Arch paid $59.5 million for its 38% share of Millennium. In May 2016, Arch transferred its entire share in Millennium to Lighthouse for no direct compensation and then assigned a zero value to its previous investments.[161] Put simply, Arch lost about $60 million as a result of Millennium. Arch's strategy of developing infrastructure to enable exports of PRB coal to Asia resulted in large losses leading to Chapter 11 bankruptcy.

As explained above, if Arch had retained its 38% share and Millennium had been permitted and built, Arch's share of estimated construction costs would have been around $260 million.[162]

6.3.2.4 Otter Creek Mine and Tongue River Railroad

As part of its strategy to develop exports of PRB thermal coal to Asian markets, Arch Coal also made the following large commitments to develop Otter Creek, a large new Montana PRB mine:

- leased Otter Creek coal reserves in 2010-2011, at a cost of $159 million;[163]
- acquired a 35% share in Tongue River (the railroad line that would be built to transport coal from Otter Creek), with an initial investment of $13 million in 2011;[164]
- sought to permit an Otter Creek mine to produce 18 MMTPY (20 million tons per year);[165]
- sought (as co-owner) to permit Tongue River.[166]

See Figure 5 and Figure 6 for maps showing the location of Otter Creek and the Tongue River Railroad, as well as other PRB mines and infrastructure.

In late 2015, Arch suspended efforts on Tongue River and wrote-off what had been spent (assigned a zero value to its previous investments).[167] Put simply, Arch lost about $22 million as a result of Tongue River. But if Tongue River had been permitted and built, Arch's share of estimated costs would have been at least $140 million and possibly over $240 million.[168]

Then in March 2016, Arch suspended efforts to develop an Otter Creek coal mine; due to capital constraints, weakness in coal markets, and difficulties in permitting, Arch could no longer devote the time, capital and resources required to develop a coal mine.[169] Put simply, Arch spent $159 million for coal reserves that were not viable to mine. But if Otter Creek Mine had been permitted and built, Arch's construction costs would have been more than $335 million.[170]

6.3.3 Current Operations and Strategy

Post-bankruptcy, thermal coal exports are a very small part of Arch operations and strategy, and Arch is not exporting PRB coal.

As shown in Table 3, Arch Coal is the second largest US coal producer. Arch US production was close to 100 MMst in 2016 and 2017; about 8% of this production is exported.[171] Arch produces both thermal and metallurgical coal, which differ in key ways. Arch Coal is the second largest US producer of thermal coal, with the vast majority mined in Wyoming Powder River Basin to supply domestic markets; Arch is also a major metallurgical coal producer:

> Arch Coal is a leading producer of metallurgical coal and the second largest producer of thermal coal in the nation.
>
> […]
>
> Arch produces the vast majority of its thermal coal from its operations in the Southern PRB - the nation's largest and lowest cost coal-supply region. Operating two large surface mines, Black Thunder and Coal Creek, the company ships coal to power generators across the U.S.[172]

Close to 10% of Arch production is metallurgical coal (about 8 MMst in 2017) from Appalachian (West Virginia) underground mines. About 80% of this is exported to global markets outside North America.

Around 90% of Arch production is thermal coal (about 89 MMst in 2017). Virtually all (about 90%) of this thermal coal (about 80 MMst in 2017) is produced at two Wyoming Powder River surface mines: Black Thunder (about 71 MMst) and Coal Creek (about 9 MMst). Arch is the second largest PRB coal producer (after Peabody), and Black Thunder is the second largest Power River Basin mine (after Peabody's North Antelope Rochelle).

Outside of the Powder River Basin, Arch thermal coal production (about 9 MMst in 2017) includes bituminous coal mines in Colorado, Illinois, and West Virginia.

Virtually all Arch thermal coal production supplies US markets to generate electricity. But with recent relatively high coal prices in export markets, Arch is exporting thermal coal from Colorado (West Elk) and (starting in the second half of 2017) from West Virginia (Coal-Mac). Arch exported about 2 MMst in 2017 and plans to export about 4.5 MMst in 2018. Exports are about 2% of total thermal coal production in 2017 and 5% in 2018.

Arch exports to global markets via existing East Coast, Gulf Coast, and West Coast terminals.[173] Arch operates and owns 35% of Dominion Terminal Associates, a coal transloading facility in Newport News, Virginia, with rated throughput capacity of 20 MMTPY (22 MMst per year). This facility is used to export metallurgical and thermal coal produced by its owners, as well as third parties.

Recently and going forward, Arch is focusing capital expenditures on higher margin metallurgical coal.[174] Capital expenditures for lower margin thermal coal are limited to minimal levels: only about $6 million in 2016, $18 million in 2017, and $27 million in 2018, with only about a third of these expenditures in the Powder River Basin.[175] Arch is managing its PRB mines to be low-cost suppliers to domestic markets, which are expected to remain sizable and relatively stable in the near to intermediate term.

As discussed in Section 6.3.2, in the period leading up to bankruptcy in 2016, Arch attempted to develop PRB exports to Asia and spent over $240 million on its 38% share of Millennium and to expand coal production. Post-bankruptcy, Arch emphasizes that it is minimizing debt and capital spending, and maximizing cash flow for return to investors.[176]

Compared with the PRB export strategy that Arch was pursuing prior to bankruptcy, Arch's thermal coal export activities are now much smaller and less risky. Arch's thermal coal export activities are now limited to these small niches (and volumes):

- higher heat content (bituminous) coal,
- from existing low-cost mines (in Colorado and sometimes West Virginia),
- exported via existing ports and other logistics,
- not requiring large capital investments,
- when export market pricing is high enough for exports to be profitable.

Arch's total capital spending for thermal coal (and especially for Powder River Basin) is now much less than would have been required to fund Millennium construction (if Arch had retained its 38% share).

More generally, with Arch's thermal coal export activities now limited to small niches (and volumes), Arch has less risk from take-or-pay contracts for rail and port capacity.[177] Exporting coal typically requires that coal producers enter into take-or pay contracts for rail and port capacity. These contracts reserve capacity for coal producers that then must be paid for regardless of whether coal is actually exported. Coal producers are thus making advance reservations to supply an export market that is highly uncertain and variable. Hence, as explained by Arch, take-or-pay contracts are included in risk factors:

Risk Factors[178]

> […] we enter into "take or pay" contracts for rail and port capacity related to our export sales. These contracts require us to pay for a minimum quantity of coal to be transported on the railway or through the port regardless of whether we sell and ship any coal. If we fail to acquire sufficient export sales to meet our minimum obligations under these contracts, we are still obligated to make payments to the railway or port facility, which could have a negative impact on our cash flows, profitability and results of operations.[179]

Arch Coal now has a market capitalization of around $1.8 billion.[180] Much of this value relates to Arch's large and highly profitable metallurgical coal production. Arch's strategy for thermal coal is now very much focused on domestic markets. Exports of thermal coal are a very small part of Arch's operations. And Arch is "opportunistically exporting" coal when market conditions are favorable. Small volumes of thermal coal are exported from mines in Colorado (and sometimes West Virginia) when and if exports are profitable. Notably, Arch is no longer exporting PRB thermal coal.

6.4 Cloud Peak Energy

6.4.1 Introduction and Comparison with Lighthouse

Other than Lighthouse, Cloud Peak Energy (CPE) may be the other coal producer with the greatest nexus with the Millennium Project.[181] CPE solely has mines in PRB (Montana and Wyoming), hence mines that might export through Millennium. CPE is former 50% owner of Decker Mine and ongoing 100% owner of Spring Creek mine, both in Montana, and both of which have supplied coal for exports to Asia. CPE has a throughput option to export via Millennium (Section 5.6.3.3).

Cloud Peak is the third largest coal producer in the US (58 MMst in both 2016 and 2017). See Table 3, Table 4, Figure 5 and endnote 182. With its production all in the PRB, Cloud Peak is the third largest PRB coal producer, from two mines in Wyoming and one mine in Montana:

- Antelope, (Wyoming PRB, 29.8 MMst in 2016, 28.5 MMst in 2017);
- Cordero Rojo; (Wyoming PRB, 18.3 MMst in 2016, 16.4 MMst in 2017); and
- Spring Creek (Montana PRB, 10.2 MMst in 2016, 12.7 MMst in 2017).

Following the 2014 divestiture of its 50% Decker share to Lighthouse, Cloud Peak now has three PRB mines which produce more than ten times as much coal as both of Lighthouse's mines (Decker and half of Black Butte) combined.

The Spring Creek Mine is of particular relevance in regard to exports and comparisons with Lighthouse. Spring Creek is in the Montana Powder River Basin, near to Decker, producing a similar coal, and with similar markets, both domestically and for exports. By itself, Spring Creek produces more than twice as much coal as both of Lighthouse's mines, combined.

Compared with Lighthouse, CPE is a much larger coal producer and exporter, operating larger more competitive mines. So CPE would generally have a substantially higher value than Lighthouse.

As shown in Figure 11, total market capitalization for CPE is now about $110 million. Put simply, if CPE is worth $110 million, Lighthouse has much less value as a coal producer. Together with the analysis of Millennium and Lighthouse in Section 5, this comparison with Cloud Peak further confirms that Lighthouse is a very small coal producer with low (if any) value and high risk.

Figure 11: Cloud Peak Energy Market Capitalization (2010- 2018)

Source: Cloud Peak Energy and Zacks websites.[183]

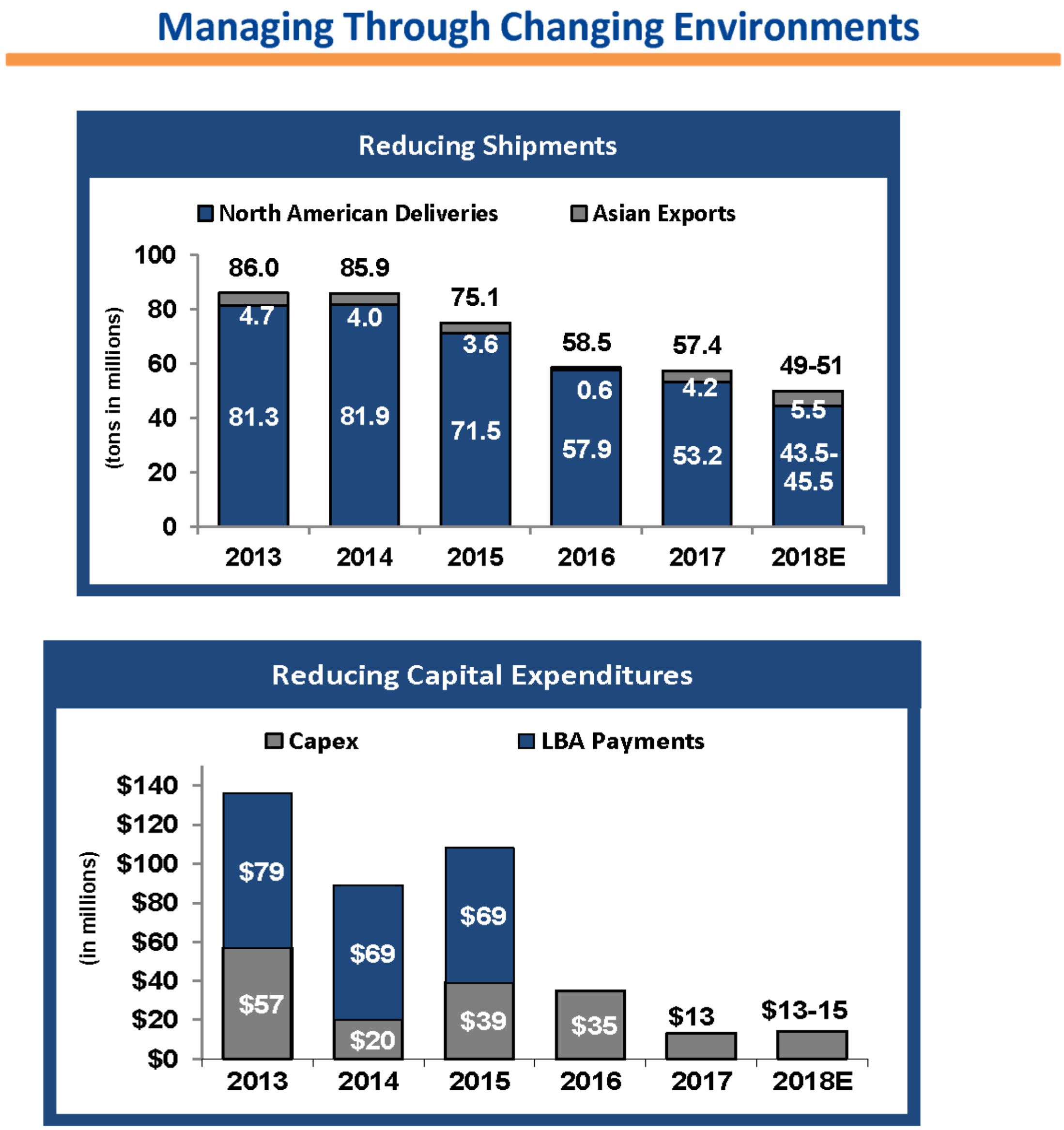
And unlike many other PRB and other US coal producers, CPE has not gone through bankruptcy. But as shown in Figure 11, Cloud Peak has nonetheless been heavily impacted by the coal industry's decline. In the period leading up to bankruptcy by Arch and other major coal producers, Cloud Peak's market capitalization sharply declined, by about 90% from mid-2014 to early 2016. Market capitalization then somewhat rebounded, but has recently declined back to where it was in early 2016.

As shown in Figure 4, US thermal coal production (notably from the Power River Basin) has declined substantially in recent years. As shown in Figure 12, shipments (coal sales) from Cloud Peak's three mines have declined by over 30% since 2014 and are estimated to decline again in 2018.

In response, Cloud Peak has dramatically reduced capital expenditures, from over $130 million in 2013, down to $13 million in 2017, and estimated to be $15-20 million in 2018. Notably, capital expenditures before 2016 included large spending to lease additional coal resources: $217 million in LBA (Lease by Application) Payments from 2013 to 2015.

Cloud Peak's declines in market capitalization, coal production and sales, together with its dramatic reduction in capital expenditures, is further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. As explained in Sections 4.8 and 5.5.5, and throughout Section 6, it is not likely or even feasible for coal producers to make large capital investments to enable a high level of ongoing exports via Millennium.

Figure 12: Cloud Peak Coal Shipments and Capital Expenditures (2013-2018)



Source: Cloud Peak Investor Presentation, October 2018.[184]

6.4.2 Exports are Variable and Relatively Small for Cloud Peak (the leading PRB exporter)

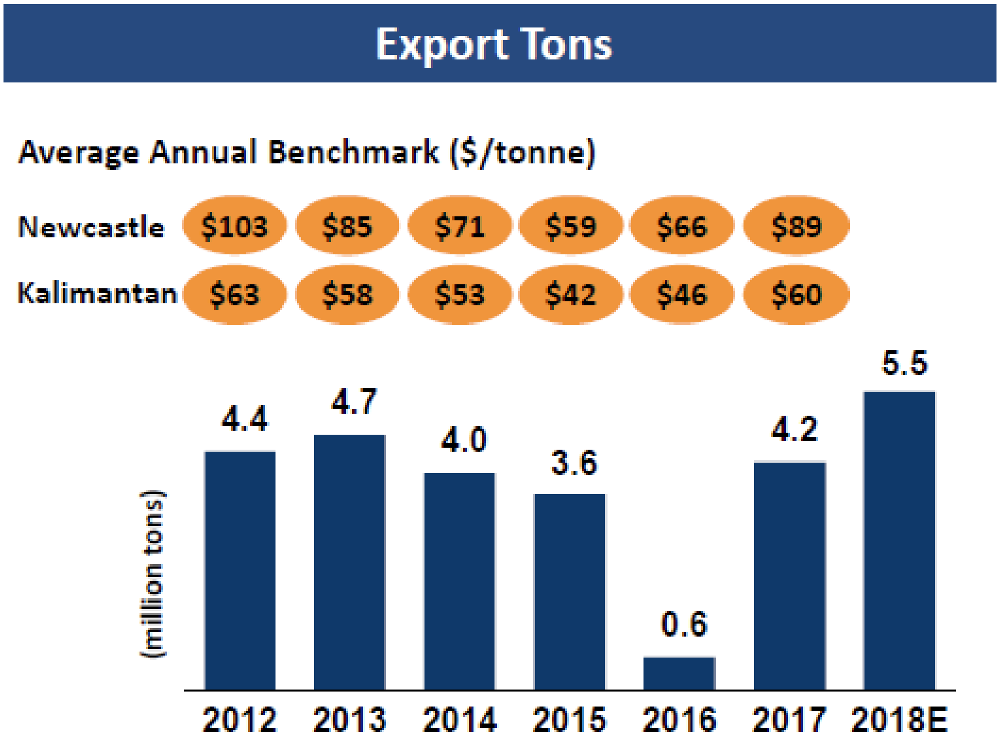
Cloud Peak has been the largest exporter from Powder River Basin:

> Cloud Peak Energy Inc. ("CPE") […] is one of the largest U.S. coal producers, with three owned and operated […] surface mines located in the Powder River Basin ("PRB") in Wyoming and Montana. […] In 2015, CPE shipped approximately 75 million tons from its three mines to customers located throughout the U.S. and around the world. […] CPE has a throughput option agreement for up to 7.7 million tons of capacity per year upon completion of the Millennium Bulk Terminals ("MBT"). CPE has been the largest single exporter in recent years of low sulfur coal from the PRB to East Asian countries that have included, among others, Japan, South Korea, and Taiwan.[185]
>
> […]
>
> Sub-bituminous PRB coal is the major coal source that MBT [Millennium Bulk Terminal] is likely to serve. […][186]

Cloud Peak is the leading PRB exporter, but exports to date have been a relatively small portion of overall CPE coal production and sales (shipments), as shown in Figure 12 and Figure 13. Since 2012, export volumes have fluctuated from minimal (0.6 MMst in 2016) to around 5 MMst (5 MMTPY) in peak years. As further explained in Section 7.6, export drivers are cyclical; export volumes are highly uncertain and variable in response to rapidly shifting market conditions (notably coal prices in Asian export markets).

Meanwhile, Cloud Peak's shipments to North American customers (mainly power plants in the US Midwest and South Central regions) have fallen by about 45% since 2013. Hence, exports as a share of total shipments have gone from about 5% in 2013-2015 to about 11% in 2018. This rising share of exports is not due to major growth in exports; it is due to dramatic and ongoing shrinkage in domestic sales.

Figure 13: Cloud Peak Export Tons and Asian Benchmark Coal Prices (2012-2018)



Source: Cloud Peak Investor Presentation, October 2018.[187]

6.4.3 Cloud Peak Export Strategy: Port and Rail Capacity

As part of the Decker Mine acquisition in 2014, Ambre also gave Cloud Peak a Millennium throughput option, estimated by Cloud Peak to have zero value.[188]

This option covers up to a total of 7 MMTPY of capacity at Millennium and would have an initial term of 10 years, with four renewal options for five-year terms. Specifically, Cloud Peak has the option for 3 MMTPY of capacity during the first phase of Millennium development and an additional 4 MMTPY once the second phase of development (Full Build-Out) is reached.

In its 2014 financial accounting for the Decker Mine divestiture to Ambre, Cloud Peak estimated that the Millennium throughput option had a value of $5 million. Hence, in its 2014 financial accounting, Cloud Peak valued the Decker divestiture to Ambre as an approximately $74 million gain: $69 million for divestiture of Decker (which had a negative net value, as explained in Section 5.6.3.2), plus $5 million for the Millennium throughput option.

But then in its 2015 financial accounting (and subsequently), Cloud Peak estimated that the Millennium throughput option now had zero value. The shift to a zero valuation for Millennium was part of a broader reconsideration by Cloud Peak regarding the value of export terminal capacity.

As explained in Section 6.4.2 (as well as Sections 5.5.4 and 5.5.5), Cloud Peak is the coal producer that has been the largest exporter from the Powder River Basin, notably from its Spring Creek Mine. Cloud Peak is also a much larger overall coal producer than Lighthouse (even after the 2014 divestiture of the 50% Decker share to Lighthouse). By itself, Cloud Peak's Spring Creek Mine produces about twice as much coal as both of Lighthouse's mines (Decker and half of Black Butte) combined.

As explained in 5.6.3.3, leading up to 2015, as part of a concerted strategy to develop exports of Powder River Basin thermal coal, Cloud Peak also:

- paid $37 million to secure additional terminal capacity at Westshore in BC;
- entered into a throughput option agreement, providing an option for up to 17.6 million tons of capacity per year at the proposed coal and other dry bulk cargo Gateway Pacific Terminal in Cherry Point, Washington; and
- in 2015, also became an 49% equity investor (together with the Crow Tribe) in the proposed Gateway Pacific Terminal.

Then in 2015, Cloud Peak reduced to zero value its throughput options at Gateway Pacific, as well as its contracted capacity at Westshore Terminal in BC, which had been valued at over $47 million. Cloud Peak also fully impaired (reduced to a zero value) its $6 million equity investment in Gateway Pacific. As noted above, Cloud Peak also reduced to zero value its throughput option at Millennium that had been valued at $5 million.

Taken together, in 2015, Cloud Peak wrote off about $58 million in relation to export terminal capacity. Cloud Peak disclosed that these large write-offs were in consideration of weak export market conditions, including:

- consensus projections of weak export pricing;
- a weak outlook for coal exports; and
- Cloud Peak's associated decision to amend port and rail contracts to require no export shipments from 2016 through 2018.

Subsequent to 2015, the Gateway Pacific Project failed to receive required permits and was canceled. The Millennium Project also failed to receive required permits, but Lighthouse is still seeking to develop the Project. As such, Cloud Peak Energy still has a throughput option at Millennium.

It should be understood that this is an option for Cloud Peak to contract for (and use) capacity at the Millennium Project, rather than a current contractual commitment by Cloud Peak that it will actually use (and pay for) capacity at Millennium.

As shown in Figure 13, Cloud Peak has used existing ports and other infrastructure to export significant volumes of PRB coal when market conditions have sometimes been favorable in recent years. Put simply, even without the Millennium Project, Cloud Peak can and does export PRB thermal coal to Asia.

In particular, Cloud Peak can and does use the Westshore Terminal. As shown in Figure 14, **Cloud Peak has confirmed that recent agreements with the Westshore Terminal (an existing lowest cost, Capesize port) provide Cloud Peak with firm export capacity foundation for many years:**

> Westshore Terminal – Existing lowest cost, Capesize port
>
> - Capesize vessels – deep-water port.
> - 5.5 million tons of port capacity 2018 –2020. […]
> - 10.5 million tons of port capacity 2021 –2022**.** […]
>
> […]
>
> <u>The new extended Westshore volumes along with the back-to-back agreements with Westshore and BNSF</u> […] <u>provide Cloud Peak Energy with a firm export capacity foundation for many years</u>.[189]

Additional information and analysis regarding Westshore are provided in Section 7.7.3. Suffice it to say here that Cloud Peak has identified these key advantages for Westshore:

- existing, operating facility;
- lowest cost;
- deepwater port;
- Capesize vessels;
- Cloud Peak's long-standing, strong relationships with both Westshore and BNSF (for rail transport from Cloud Peak mines to Westshore).[190]

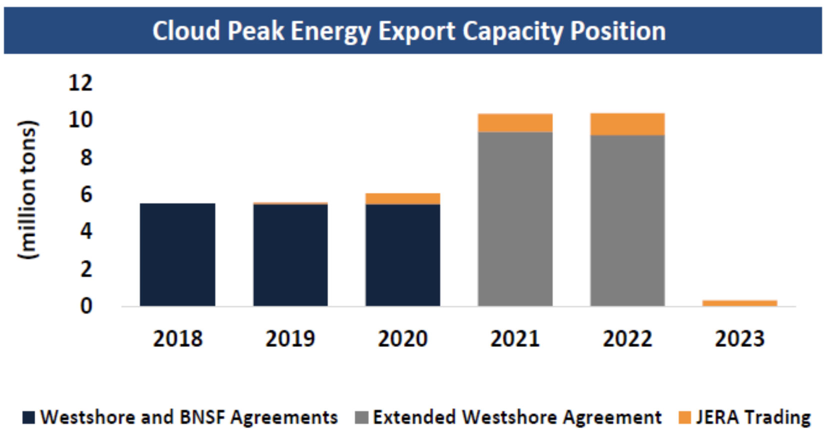
In some cases, Cloud Peak has specifically identified Westshore's advantages, relative to Millennium:

- Westshore is an operating facility, with proven capability for Cloud Peak coal exports; Millennium is proposed, has been denied required permits, and is litigating these denials;
- Westshore is a deepwater port and can load Capesize vessels; Millennium has shallower draft and is limited to smaller Panamax vessels; (Capesize vessels are the largest vessels used for coal and other dry bulk commodities, providing lower cost transport (especially for long distance routes such as Pacific Northwest to Asia)).

Figure 14: Cloud Peak Export and Terminal Capacity Position

Cloud Peak Energy – Export Position

- Amended and extended the existing Westshore agreement to December 31, 2022.
- Increased volumes to 10.5 million tons per year in 2021 and 2022.
- Retained the right to terminate the agreement at any time in exchange for a buyout payment.
- JERA Trading volumes are in the new totals for 2021 and 2022, but fall under the separate JERA take-or-pay agreement.



The new extended Westshore volumes along with the back-to-back agreements with Westshore and BNSF in support of the JERA agreements, provide Cloud Peak Energy with a firm export capacity foundation for many years.

Cloud Peak Energy Terminal Position

Westshore Terminal – Existing lowest cost, Capesize port

- Capesize vessels – deep-water port.
- 5.5 million tons of port capacity 2018 – 2020. (1)
- 10.5 million tons of port capacity 2021 – 2022. (2)
- Additional volumes for JERA Trading business through the first quarter of 2023.

Source: Cloud Peak Investor Presentation, October 2018, notes from original in endnote 191.

Another advantage of Westshore has been flexibility. Cloud Peak has repeatedly modified its export plans in response to rapidly evolving market conditions, and Westshore has provided various flexibility in regard to volumes and other contractual arrangements. For example, as shown in Figure 14, Cloud Peak has been able to negotiate for up to 10.5 MMst of port capacity in 2021 and 2022, but Cloud Peak can terminate the agreement at any time for a buyout payment.

Moreover, Cloud Peak did not need to make a long-term commitment; after 2022 Cloud Peak has no take-or-pay commitments. This flexibility is especially important given the weakened financial conditions of coal producers, including Cloud Peak. As shown in Figure 15, public companies (including Cloud Peak) must disclose take-or-pay commitments as material liabilities (similar to debt). Hence, while Cloud Peak wants to have port capacity available so that it can export, Cloud Peak also needs to be maintaining low overall take-or-pay commitments. As explained in Section 4.8 and throughout Section 6, high debt levels have been an important factor in many coal company bankruptcies.[192]

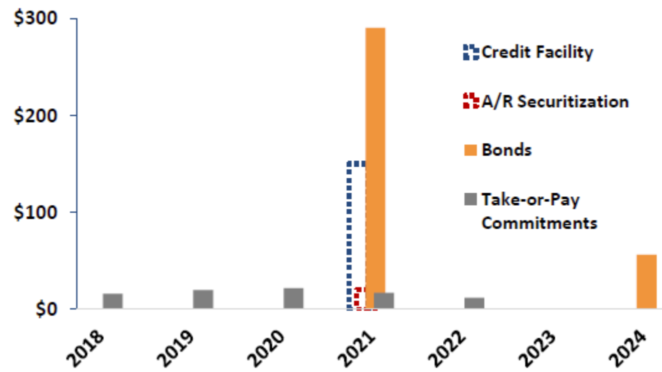
Figure 15: Cloud Peak Debt and Transportation Commitments

Actively Managing Financial Obligations and Commitments

Maturity Profile – Debt and Transportation Commitments

September 30, 2018 (in millions)	
12% Second Lien Notes due 2021	$290.4
6.375% High-Yield Notes due 2024	$56.4
Bonds Outstanding	**$346.8**
Deferred gain and other [1]	$55.1
Carrying Value of Debt	**$401.9**
Capital leases	$3.0
Total Debt on Balance Sheet	**$404.9**
Total Debt / TTM Adjusted EBITDA [2]	**4.5X**
Net Debt / TTM Adjusted EBITDA [2]	**3.1X**

Transportation Commitments [3] (in millions)	
2018	$ 7.9
2019	$26.2
2020	$21.7
2021	$16.8
2022	$12.5



- **Nearest principal maturity is 2021.**
- **Port and rail agreements were replaced in late 2017 and early 2018 to better meet our future export needs while maintaining low overall take-or-pay commitments.**

(1) Represents the deferred gain on the Q4 2016 bond exchange transaction less unamortized debt issuance costs and cash premium paid.
(2) Total debt includes high-yield notes and capital leases.
(3) Commitments represent replacement Westshore and BNSF agreements. See Item 1 – Note 5 "Transportation Agreements" of our Notes to Unaudited Condensed Consolidated Financial Statements in our September 30, 2018 Form 10-Q for additional information and Item 7 – "Management's Discussion and Analysis of Financial Condition and Results of Operations – Contractual Obligations" in our 2017 Form 10-K.

Source: Cloud Peak Investor Presentation, October 2018.[193]

The US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. As explained in Sections 4.8 and 5.5.5, and throughout Section 6, it is not likely or even feasible for coal producers to make large capital investments to enable a high level of ongoing exports via Millennium.

Likewise, coal producers that are potential customers for Millennium need to be cautious about making large, long-term commitments for terminal capacity, because any such commitments will be treated as large debts. Westshore is an existing facility with a diverse customer base, so it can be somewhat flexible about contractual arrangements and term of commitments.

Millennium is a proposed facility with large up-front capital costs (estimated at $680 million). Put simply, it would be high risk to spend $680 million on a speculative project unsecured by customer commitments to actually use and pay for capacity. But

Millennium now has only two agreements with third parties to ship coal via Millennium, and these are throughput options (with Cloud Peak and Arch) that are not firm commitments to actually use or pay for Millennium capacity.[194]

Moreover, as part of the recent agreements, Westshore now has priority rights on throughput capacity for any Cloud Peak exports.[195] Put more simply, Westshore now has first call on any coal that Cloud Peak seeks to export.

As a result, Cloud Peak is even less likely to export coal via the Millennium Project. In particular, it is now even less likely that Cloud Peak would exercise its throughput option with Millennium.

Based on the analysis of the publicly available information, TGG thus concludes:

- Cloud Peak has been the leading exporter of Power River Basin coal, but export volumes to date have been limited and highly uncertain and variable;
- Cloud Peak can and does export thermal coal when market conditions are favorable, using existing ports and infrastructure, notably the Westshore Terminal;
- Cloud Peak is constrained in making commitments to enable exports; these commitments (notably take-or-pay contracts for port and rail capacity) are obligations that must be disclosed to investors and maintained at low levels;
- Cloud Peak is also constrained in making capital expenditures and is managing this capital spend to low levels;
- Westshore has priority rights to any coal that Cloud Peak exports.
- Cloud Peak has a throughput option with the Millennium Project; Cloud Peak was granted this option as part of the divestiture of the Decker Mine; Cloud Peak did not provide any direct compensation for this throughput option, and Cloud Peak financial accounting estimates a zero value for this throughput option;
- permit denials by State of Washington in regard to the Millennium Project have not been demonstrated to have any significant impact upon coal exports by Cloud Peak; the available information confirms that there has been no significant impact to date; any future impact is speculative and unlikely to be substantial, especially in nearer-term.

6.5 Other PRB Coal Producers

6.5.1 Peabody

Peabody is the largest coal producer in the US (143 MMst in 2016 and 157 MMst in 2017). See Table 3, Table 4, Figure 5 and endnote 196.

Peabody is also the largest PRB coal producer (112 MMst in 2016 and 157 MMst in 2017, from 3 mines in Wyoming):

- North Antelope/Rochelle (the world's largest coal mine, 93 MMst in 2016 and 102 MMst in 2017);
- Caballo; and
- Rawhide.

Peabody's PRB production comprises over a third of total PRB production and over three-quarters of total Peabody US production.

As explained in Section 4.8, Peabody entered Chapter 11 Bankruptcy in 2016, shortly after the Arch Coal filing.

The Peabody bankruptcy predates and was in no way the result of permit denials by State of Washington in regard to the Millennium Project. Peabody entered Chapter 11 Bankruptcy in April 2016 and exited in October 2016. The Millennium Project FEIS was issued in April 2017. Washington Department of Ecology issued its denial of Section 401 Certification for the Project on September 26, 2017.

In 2011, Peabody announced an agreement to export up to 24 MMTPY through the Gateway Pacific Terminal, with actual volumes dependent on market demand and other factors:

> Peabody Energy […] announced an agreement with SSA Marine [project developer] to initially export up to 24 million metric tons of coal per year through the planned Gateway Pacific Terminal in Whatcom County in northwest Washington. Coal export volumes would be dependent upon global market demand, terminal capacity and other factors.[197]

The Gateway Pacific project was even larger than Millennium and could potentially have enabled a sizable level of PRB thermal coal exports.[198] But from the limited publicly available information, Peabody's agreement with Gateway Pacific does not appear to have been a firm commitment to export via that terminal, and it did not require Peabody to provide financing. Hence, Peabody's agreement with Gateway Pacific was much more conditional and lower-cost and risk than other agreements between PRB coal producers and terminal projects, including:

- Cloud Peak's 49% ownership share of Gateway Pacific (Section 6.4.3); and
- Arch coal's 38% ownership share of Millennium (Section 5.6.5).

Peabody's agreement with Gateway Pacific was more similar to the Millennium throughput options given to Cloud Peak and Arch Coal (Section 5.6.3.3, 5.6.5, and 6.4.3). But unlike those other throughput options, Peabody's agreement with Gateway Pacific appears to have been preliminary and never finalized, such that Peabody's bankruptcy did not require it to modify its relationship with Gateway Pacific.

In any event, the Gateway Pacific project has now been canceled, and Peabody has no ongoing involvement.

Very recently in 2018, Peabody has relinquished some of its PRB federal coal leases:

> In Peabody Energy's recent relinquishment of some of its federal coal leases, the company is cleaning up its production cost side in the face of declining demand, particularly for the lower-quality 8400 BTU product that comes out of the Powder River Basin.
>
> The particular Wyoming coal in question has gone from being an asset to a liability, and Peabody considers it now an economically unextractable asset.
>
> The move, which affects reserves associated with the Caballo and Rawhide mines, is notable for its reflection of the big picture on a couple of points. First, Peabody is the biggest U.S. coal producer. And second, the Powder River Basin is the largest coal reserve in America.[199]

The Peabody bankruptcy and very recent relinquishing of PRB federal coal leases are further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. As explained in Sections 4.8 and 5.5.5, and throughout Section 6, it is not likely or even feasible for coal producers to make large capital investments to enable a high level of ongoing exports via Millennium.

6.5.2 Westmoreland

Westmoreland is a major US coal producer (ranked #8 in 2016 with close to 30 MMst production); almost half of this production is at two PRB mines (Rosebud and Absaloka). See Table 3, Table 4, Figure 5 and endnote 200.

Westmoreland entered Chapter 11 Bankruptcy in October 2018. This very recent bankruptcy is further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options. These difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. As explained in Sections 4.8 and 5.5.5, and throughout Section 6, it is not likely or even feasible for coal producers to make large capital investments to enable a high level of ongoing exports via Millennium.

It should also be understood that the Westmoreland bankruptcy was not the result of permit denials by State of Washington in regard to the Millennium Project. Westmoreland's PRB mines are in Montana and supply domestic markets, notably power plants that are adjacent or otherwise proximate. These domestic markets are in decline for multiple reasons, but this decline predates and is independent of the permit denials by State of Washington in regard to Millennium.

6.5.3 Alpha/Contura/Blackjewel

Production from the Eagle Butte and Belle Ayr Mines in the Wyoming Power River Basin (around 33 MMst in 2016 and 2017) comprises about 10% of overall PRB production[201] These mines were formerly owned by Alpha Natural Resources. As explained in Section 4.8, Alpha entered Chapter 11 Bankruptcy in 2015, prior to the Arch Coal and Peabody bankruptcies in 2016.

The Alpha Natural Resources bankruptcy predates and was in no way the result of permit denials by State of Washington in regard to the Millennium Project. Alpha entered Chapter 11 Bankruptcy in August 2015 and exited in July 2016. The Millennium Project FEIS was issued in April 2017. Washington Department of Ecology issued its denial of Section 401 Certification for the Project on September 26, 2017.

As part of its bankruptcy, Alpha divested its PRB mines, with ownership shifting to Contura (which is now seeking to merge with Alpha).

In 2017, Blackjewel acquired the Eagle Butte and Belle Ayr Mines from Contura in exchange for Blackjewel assuming reclamation obligations, and for zero, or possibly negative $21 million, in direct compensation. As explained in Section 5, coal mines have sizable liabilities for asset retirement (notably for mine reclamation).

When Lighthouse (then known as Ambre) was acquiring the Decker and Black Butte mines in 2011 and 2014, valuations for these mines were low, because they were small, older mines where the economically viable coal resources were depleted. The value to the sellers of Decker and Black Butte (Level 3 and Cloud Peak) was that sizable liabilities (notably for mine reclamation) were transferred to Lighthouse.

The very recent transfer of the Eagle Butte and Belle Ayr Mines for zero (and possibly negative) direct compensation is further confirmation that the US coal industry and especially PRB producers continue to be faced with difficult economic challenges and limited options; these difficulties are if anything intensifying, such that specific producers, mines, and coal resources are low- (and possibly negative-) value. Hence, as explained in Sections 4.8 and 5.5.5, and throughout Section 6, it is not likely or even feasible for coal producers to make large capital investments to enable a high level of ongoing exports via Millennium.

7 Potential for Coal Exports via Millennium

7.1 Key Findings

Finding 1: The economic potential for significant coal exports via Millennium is limited (Section 7.5)

Finding 2: The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. (Sections 7.4, 7.5, 7.7)

Finding 2: US thermal coal exports in general and PRB exports in particular are faced with a number of economic challenges and structural disadvantages, which are intensifying. (Section 7.5)

Finding 3: Large-scale shifts in the world energy system have affected the long-term outlook for coal demand in Asia, particularly in Millennium's key export markets: market conditions will be unfavorable overall given the shrinkage of imports in most mature Asian markets, which may only be partially offset by growth in emerging Asian markets. (Section 7.5)

Finding 4: Uncertainty about growth in these emerging markets coupled with global shifts to renewables indicate ongoing evolution of even less favorable market conditions (more shrinkage in mature markets and less growth in emerging Asian markets.) (Sections 7.5.1, 7.5.3)

Finding 5: WEO 2017 projects that the global market for coal exports has peaked and will decline over the long term. Neither the IEA nor the EIA projects that there will be a high volume of US thermal coal exports to Asia. (Section 7.5.2)

Finding 6: The likelihood of lags in mainstream economic projections at a time of global shifts implies that the long-term projections for thermal coal imports in Asia may still be overly optimistic. Future projections could be even less favorable for Millennium. (Section 7.5.4)

Finding 7: Current relatively high coal prices should not be taken as an indicator of long-term favorable market conditions for Millennium. (Section 7.6.1)

Finding 8: Based on long-term projections from the IEA and EIA, port capacity will not be a major constraint on US exports and specifically coal exports to Asia. Existing ports can and do provide high-quality alternatives to Millennium for the export of PRB coal. (Section 7.7)

The Findings from this section are supportive of five of the seven overarching Key Findings of this report (Key Findings 2 through 6 from Section 1.1):

Key Finding 2: The Project is a speculative venture that is unlikely to operate at high levels of throughput over the long-term. (Section 7.5)

Key Finding 3: The Project is not needed to supply coal to Asia. Countries that could conceivably be served by exports from Millennium can easily meet their coal requirements from other sources, including Australia and Indonesia. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. (Section 7.5)

Key Finding 4: A number of other port alternatives exist that can meet the intermittent and shrinking Asian demand for US thermal coal exports. (Section 7.7)

Key Finding 5: US thermal coal exports face a number of economic challenges and structural disadvantages in the global markets, which are intensifying. These competitive challenges are unrelated to port capacity and will not be overcome by Millennium. (Section 7)

Key Finding 6: The denial of the permits has no significant effect on the US domestic coal industry. (Section 7)

In light of the above Findings, Section 7 is strongly supportive of TGG's Central Finding in this report: **Washington State's permit denials for the Project do not significantly affect the US coal industry, nor US coal exports to Asian markets.**

7.2 Introduction

The economic potential for significant coal exports via Millennium has decreased considerably since the Project was first investigated and proposed in 2009-2012. There have been large-scale shifts in the world energy system, which have affected the outlook for coal demand in Asia, particularly in Millennium's key export markets (notably South Korea and Japan).

The US is a swing supplier to global markets (both generally and particularly in relation to exports via Millennium) and is expected to remain so (Section 7.3). US thermal coal exports in general and PRB exports in particular are faced with a number of existing structural disadvantages (Section 7.4.1) and other economic challenges, particularly take-or-pay commitments (Section 7.4.2).

Longer-term coal market projections indicate that the existing structural disadvantages for PRB coal will only intensify between now and 2040 (Section 7.5) due to the following factors:

- Coal exports are projected to decline in the more mature Asian economies, but grow in emerging Asian economies. Demand in Asia is shifting to be less proximate to Millennium and more proximate to competitors (notably Indonesia and Australia). (Section 7.5.1)

- WEO 2017 projects that the global market for coal exports has peaked and will decline over the long term. Neither the IEA nor the EIA projects that there will be a high volume of US thermal coal exports to Asia. (Section 7.5.2)

- According to WEO 2017, one of the large-scale shifts in the global energy system is the rapid rise and falling costs of renewables and other clean energy technologies. This explosive growth spells the end of the global coal boom. Growth in renewables is expected to accelerate, while growth in coal slows. (Section 7.5.3)

- The likelihood of lags in mainstream economic projections at a time of global shifts implies that the long-term projections for thermal coal imports in Asia may still be overly optimistic. The shifts in the global energy system are large, rapid, ongoing and possibly accelerating. Hence, the long-term outlook for US coal exports may continue to worsen. Future projections could be even less favorable for Millennium. (Section 7.5.4)

Coal exports are also subject to shorter-term fluctuation market conditions that are highly uncertain and variable. Since 2006, coal prices have been highly volatile and cyclical, accompanied by repeated booms and busts. These wide price variations dramatically affect short-term profitability, but do not reflect long-term economic fundamentals. Given boom and bust cycles in the commodity markets, as well as China's coal market restructuring process, it would be imprudent to infer that current relatively high coal prices imply long-term potential for exports via Millennium. (Section 7.6).

Long-term projections from the IEA and EIA indicate that port capacity will not be a major constraint on US exports and specifically coal exports to Asia. Existing ports can and do provide high-quality alternatives to Millennium for the export of PRB coal. (Section 7.7)

Based on WEO 2017 and AEO 2018, the existing economic challenges and structural disadvantages for coal exports from the PRB will continue to intensify. The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. Therefore, the longer-term outlook for exports via Millennium has significantly deteriorated since the Project was first proposed and may in fact continue to worsen. (Section 7.8)

7.3 Economics of Swing Supply

The US is a swing supplier to global coal markets, both generally and particularly in relation to exports via Millennium (PRB thermal coal to Asia). The US coal industry mainly supplies large domestic markets and also opportunistically exports when conditions are favorable. Export volumes are highly variable based on fluctuating market conditions, but even when export volumes are high, they are a small portion of total US thermal coal production and a tiny portion of global coal markets.

7.3.1 US is generally swing supplier to global coal markets

The positioning of the US as a swing supplier to global coal markets is widely recognized and confirmed in numerous analyses, including by International Energy Agency and US National Coal Council

The IEA's recent analysis of the global coal industry (IEA Coal 2017) confirms that the US is a swing supplier to global markets and is expected to remain so. More favorable US regulations will not change the US position on the seaborne supply curve, nor its position as a swing supplier.

> **The United States is set to remain a swing supplier to international coal markets**. Recent change in the policy and regulatory environment are [sic] reducing costs for US producers, but will not significantly change their position in the seaborne supply curve. In 2017, a rise in coal imports and prices led to greater US exports; but as prices ease, so will exports. […] Uncertainty about the level of US exports will be the highest among all major coal exporters given the role of the United States as a swing

supplier.[202]

[…]

US coal exports began declining in 2012, and fell further in 2016. Looking ahead to 2022, seaborne traded thermal coal exports are expected to remain constant and the United States will remain a swing supplier: if imports increase for any reason in the Asian market (in China, India or Korea), US producers can fill the gap, as happened in 2017. Although favorable new US regulations will help reduce costs for producers, they will not change the placement of the United States on the global supply curve or its position as a swing supplier.[203]

At the request of Energy Secretary Rick Perry, the National Coal Council (NCC) produced an October 2018 white paper to assess the opportunities for US coal exports. In this white paper, the NCC confirms that the US is a swing supplier for thermal coal:

Key suppliers to the global coal trade have been Australia, Indonesia, Russia, Colombia, South Africa and the U.S. While the U.S. is a major exporter of metallurgical coal, it is generally considered a "swing" supplier with respect to thermal coal.[204] [205]

The positioning of the US as a swing supplier is not a recent development.[206] The US has been a swing supplier to global thermal coal markets since the 1980s. This positioning could be sustained because the export market is secondary to the main domestic market. Put another way, the US coal industry mainly supplies large domestic markets and also opportunistically exports (provides some supply to global thermal coal markets if and when conditions are favorable). Export volumes are highly variable based on fluctuating market conditions. But even when export volumes are high, they are a small portion of total US thermal coal production.

The interaction of swing suppliers (such as the US) and export-oriented suppliers (such as Australia and Indonesia) is explained by Trüby and Paulus as follows:

THE SEABORNE STEAM COAL TRADE MARKET

[…] two different types of suppliers interact with each other: countries that have a dedicated export-oriented mining industry and countries with chiefly inland-oriented mining industries. [footnote in original omitted] The former type primarily comprises South Africa, Colombia, Australia, and Indonesia and represents most of the supply capacity for the international trade market. These export industries usually have a cost advantage over domestic industries due to good coal qualities, low mining costs, and economical access to transport infrastructure. The latter type primarily consists of China, the USA, and Russia. These countries have some dedicated export collieries, but most of the potential export capacity can serve both the national and the international markets. Depending on the relation of export prices to domestic prices, these mines supply either domestic consumers or maritime trade markets (swing suppliers). The majority of domestic mines are always extramarginal to international markets due to low coal quality, contractual obligations, high supply costs, or lack of access to infrastructure.[207]

7.3.2 Exports via Millennium would be a swing supplier to Asian coal markets

Exports of PRB thermal coal (via Millennium or port alternatives) are swing (marginal) sources of supply to export (and particularly Asian seaborne) markets. When prices are low in those markets, exports from the US are typically not competitive and not profitable for US producers. But when prices are high in those markets, exports from the US are potentially competitive and profitable for US producers. Hence, US thermal coal exports have and can be highly volatile, varying from zero or small volumes (when prices are low in export markets), to greater volumes (when prices are high in export markets).

The Millennium Project would supply Asian seaborne markets for lower quality thermal coal. These markets are very competitive and price sensitive. These markets are dominated by supply from Indonesia which is advantaged by geographic proximity (shorter distances for ocean shipping and resulting shorter shipping times and lower shipping costs).

As explained in Sections 5.6.3.3 and 6.4, Cloud Peak Energy (CPE):

- is the third largest PRB coal producer;
- has a throughput option for up to 7 MMTPY (7.7 MMst) at the Millennium Project, and
- has been the largest single exporter of PRB coal.

In its 2016 Comments on the Draft EIS for Millennium, Cloud Peak clearly states that PRB thermal coal is exported to Asia (via Millennium or port alternatives) as swing supply:

> CPE has been the largest single exporter in recent years of low sulfur coal from the PRB to East Asian countries that have included, among others, Japan, South Korea, and Taiwan. PRB coal is supplied to Asian countries as a swing supplier depending on the pricing environment […] As a result of being a swing supplier and depressed seaborne coal prices, CPE is not currently exporting coal to Asia.[208]
>
> […]
>
> Asian countries that could conceivably be served by coal exports from MBT could easily meet their coal requirements from a number of sources other than the U.S., including Russia, Colombia, Indonesia, Australia, and China. […] Currently, depressed seaborne coal prices as well as a strong U.S. dollar make exports from the PRB temporarily unprofitable. Even in prior periods with more robust seaborne coal prices, PRB coal remained a swing supplier to East Asia based on transportation costs and variations in coal quality and heat content across competing coal basins.
>
> Sub-bituminous PRB coal is the major coal source that MBT is likely to serve. It is, from a quality and price perspective, likely to compete with Indonesian coal […]
>
> U.S. coal exports offer East Asian power plants additional energy security through supply diversity […] Nevertheless, U.S. coal exports must be competitively priced to access East Asian customers […] these exports fulfill the swing supplier needs […][209]

In response to CPE's comments, the EIS preparers confirmed that the Coal Market Analysis analysis and findings agree that Millennium Project would primarily serve PRB coal producers and compete with Indonesian coal:

> The assumptions used in the analysis and findings agree with the commenter's assertion that the proposed terminal would primarily serve Powder River Basin coal producers and that it would compete with Indonesian coal.[210]

In 2017 disclosures to investors, CPE has also emphasized that US exports to Asia must compete with other lower cost suppliers, notably Indonesia, which is advantaged by proximity and lower transport costs. Given fundamentals, CPE recognizes that the US will never be at the low end of the cost curve for seaborne thermal coal exports.

> […] realistically, we're never going to be at the low—the bottom of the cost curve internationally because of just the distance we are from the coast and compared to Indonesia and to the customers compared to Indonesia. So, we need to recognize that and position ourselves accordingly.[211]

For Cloud Peak, this recognition of competitive realities has meant shedding expensive commitments to export, limiting take-or-pay commitments (notably for rail and Westshore, while seeking to export coal to Asia opportunistically (when opportunities arise).

In particular, Cloud Peak now emphasizes that it has "learned its lesson" as to the need to be cautious and incremental in committing to additional rail and port capacity, and thus increasing pay-or-pay commitments; CPE has learned its lesson from past experience about the risks of supplying an export market that is cyclical, variable, and uncertain

In Cloud Peak's Earnings Conference Call on Q3 2017 Results, CEO Colin Marshall explained the need for CPE to be cautious and incremental in committing to additional rail and port capacity, and thus increasing pay-or-pay commitments, and that CPE has learned this lesson from past experience: https://seekingalpha.com/article/4117132-cloud-peak-energys-cld-ceo-colin-marshall-q3-2017-results-earnings-call-transcript?part=single

> **Colin Marshall**
>
> So, I think in terms of the expectation is as long as the price is supportive in making some money on it than we will, you know both ourselves the railway and the Westshore with the expectations that we will keep extending those contracts. We got to make sure that we don't get ahead of ourselves and take on too many take or pays recognizing the prices. There is no reason they will at some stage presumably go down to levels they were a year or two ago or last year when we couldn't export. So, we will be cautious about moving those forward, but it is good business at the moment for ourselves, Westshore and the BN and we've tried to adjust those agreements to make sure that will allow us to keep exporting.
>
> So, I think we will look to extend those and update you as we do that, but we will be very cautious about not taking on too much take or pay risk. We've sort of learnt our lesson on that. In terms of the actual pricing, well there is some

> variability in the agreements that they announced to let us keep exporting as the price of new customer maybe drops away. I won't give you an exact number, but clearly when it's above $60 that's good, when it is getting down 55-ish and that is a level that's not so good.
>
> So, this is the Indonesian price, the Kalimantan price and obviously what we have seen recently is whilst the Newcastle price has been near terms has been around about $100 and has actually been some steady moment up in the Indonesian price, which is now at 66, which sort of lagged, I guess the New Castle and the web [ph] and that's encouraging because we do see this tightness in the variability and quality and the coal coming out of Indonesia. So overall it is pretty positive and we want to keep sort of rolling things forward that we want to make sure we don't get too far ahead of ourselves […].

7.4 Existing Structural Disadvantages and Economic Challenges for PRB Coal Exports

As discussed in the previous section, the US has been a swing supplier to global coal markets since the 1980s and is expected to remain so. Moreover, US thermal coal exports in general and PRB exports in particular are faced with a number of existing structural disadvantages (as discussed in Section 7.4.1) and other economic challenges, particularly take-or-pay commitments (as discussed in 7.4.2).

7.4.1 Structural Disadvantages

Powder River Basin exports to Asia face particular competitive disadvantages: (a) production is far from the coast and destination markets; (b) US exports must compete with lower-cost suppliers (notably Indonesia) which are advantaged by proximity and lower transport costs; and (c) PRB coal has several quality issues, which exacerbate the high cost of shipping: low heat/high moisture content and (sometimes) high sodium. PRB exports have some competitive advantages, which help producers to export as swing suppliers when the market conditions allow. However, their competitive disadvantages generally outweigh their advantages, such that they are expected to remain high-cost producers. As such, the US will never be at the low end of the cost curve for seaborne thermal coal exports.

7.4.1.1 Competitive Disadvantages of PRB exports in the Asian Seaborne Market

The following factors have historically limited the economic viability of exporting PRB coal compared to coal with higher heat content, thermal coal, or coking-quality coal.

- Long distances to export terminals
- Abundant international coal supply
- Relatively low international coal prices
- Relatively high shipping costs compared to international coal sources
- Lower international demand for steam coal [footnote 2 in original omitted] than for coking-quality coal.

As explained in FEIS and other coal market analysis, supply from the US (and particularly PRB and Uinta) has several competitive disadvantages in the Asian seaborne market:

- distance/cost of shipping
- lower heat content, which exacerbates high cost of shipping
- other coal quality issues (high moisture content, sodium)
- limited market presence (coal buyers (and especially some users) prefer established sources of supply, track record, coal quality).

Meanwhile, established suppliers to Asian seaborne markets are better positioned than US suppliers owing to some combination of:

- shorter distance/lower cost of shipping
- higher heat content, which reduces cost of shipping
- coal quality well matched to customer requirements
- established market presence.

7.4.1.2 PRB Coal Quality Issues

Coal quality issues represent a particular competitive disadvantage for Potential PRB Coal Exports via Millennium.

As explained in Sections 4.3 and 4.4, thermal coal includes a wide diversity of coal types and properties. Thermal coal is primarily used to generate electricity in power plants. These power plants are typically designed, configured, and operated to use coal with specific characteristics. There is typically some (but limited) flexibility for using coal with a range of characteristics.[212]

Hence, specific markets for thermal coal (such as for exports via Millennium) are to some extent granular (differentiated and specialized based on the characteristics of coal produced by individual mines and used in individual power plants). But there is typically a substantial amount of linkage between specific markets, such that pricing for coal with various characteristics are related and move together. Put simply, favorable market conditions typically result in higher prices in various specific markets for coal with various characteristics; likewise, unfavorable market conditions result in broadly lower coal prices. Nonetheless, as demonstrated by recent market conditions, there can be divergence (especially shorter-term) in price trends for coal with specific characteristics, and even for the benchmark coal prices.[213]

Compared with bituminous thermal coal, PRB coal is lower quality owing to lower heat content and higher moisture content. But Montana PRB coal does typically have somewhat higher heat content (around 9300 Btu/lb), compared with Wyoming PRB (around 8400-8800 Btu/lb).

And PRB coal (from both Montana and Wyoming) does have some quality advantages in terms of low sulfur and ash content.

So compared with sub-bituminous thermal coal from Indonesia, PRB coal (especially from Montana) might appear to have similar or even somewhat higher quality.[214]

But coal quality and competitive position can vary based on a number of factors. For example, while PRB coal from Montana has a higher heat content than coal from Wyoming, Montana coal can also have a higher sodium content, which adversely affects its value and marketability.

Coal from Northern Powder River Basin (Montana) mines can be high in sodium, with concentrations ranging up to and above 8%, which is much higher than the less than 2% and sometimes 1% typical for the Southern Powder River Basin (Wyoming). High sodium can cause slagging and fouling problems at power plants, so markets for high-sodium coal are limited.[215]

Notably, sodium content is an issue for both the Lighthouse Decker Mine and the Cloud Peak Spring Creek Mine.[216] As a result, coal from these mines is lower quality and less valuable than would otherwise be the case given other characteristics (notably heat and sulfur content, as discussed in Section 4.7).

7.4.1.3 Some Competitive Advantages of PRB exports in the Asian Seaborne Market

Despite the competitive disadvantages described above, PRB producers have some potentially significant competitive strengths, namely:

- low production costs (especially at the lower cost mines); and
- very large resource base such that production may be able to be maintained or even expanded without large increases in production costs ("flat supply curve").

These competitive advantages help producers to export as swing suppliers when the market conditions are favorable. However, the competitive disadvantages generally outweigh the advantages, such that PRB producers are expected to remain high-cost suppliers to the Asian seaborne market.[217]

7.4.2 Take-or-pay Commitments

To access Asian export markets, Powder River Basin producers must make take-or-pay commitments, which are obligations to pay a minimum amount for rail and port use to transport the coal even if these transportation logistics go unused. Take-or-pay commitments are an additional economic risk for coal export swing suppliers because they are required to make advance reservations to supply a market that is highly uncertain and variable. When coal prices are low in the Asian markets, exports from PRB are typically not profitable for producers. Under these conditions, producers may be forced to pay the take-or-pay commitments to avoid having to export at an even greater loss (as was the case with Cloud Peak and Arch Coal using existing logistics in 2014-2016). Especially for high-volume exports via Millennium, Powder River Basin producers would have to make large economically risky commitments for rail and terminal access.

Cloud Peak recently discussed the competitive disadvantages of take-or-pay commitments. in its 2017 Form 10-K Annual Report to SEC:

> [W]e have significant multi-year take-or-pay contracts for rail and terminal capacity related to our logistics services for export sales. These contracts require us to pay for a minimum quantity of coal to be transported on the railway or through the terminal regardless of whether we sell any coal or the prices we receive for our coal or logistics services. If we fail to make sufficient export sales to meet our minimum obligations under these take-or-pay contracts, we are still obligated to make payments to the railway or terminal, which could have a negative impact on our cash flows, profitability and results of operations. As of December 31, 2017, we had take-or-pay commitments of $45.7 million that could be potentially payable if we fail to meet our minimum shipment obligations. See Item 7—"Management's Discussion and Analysis of Financial Condition and Results of Operations—Contractual Obligations."[218]

Peabody had a similar discussion of the disadvantages of take-or-pay in its 2017 Form 10-K Annual Report to SEC:

> **Take-or-pay arrangements within the coal industry could unfavorably affect our profitability.**
>
> We have substantial take-or-pay arrangements, predominately in Australia, totaling $1.3 billion, with terms ranging up to 25 years, that commit us to pay a minimum amount for rail and port commitments for the delivery of coal even if those commitments go unused. The take-or-pay provisions in these contracts sometimes allow us to apply amounts paid for subsequent deliveries, but these provisions have limitations and we may not be able to apply all such amounts so paid in all cases. Also, we may not be able to utilize the amount of capacity for which we have previously paid. Additionally, coal companies, including us, may continue to deliver coal during times when it might otherwise be optimal to suspend operations because these take-or-pay provisions effectively convert a variable cost of selling coal to a fixed operating cost.
>
> Take-or pay "...commits us to pay a minimum amount for rail and port commitments for the delivery of coal even if those commitments go unused ... coal companies, including us, may continue to deliver coal during times when it might otherwise be optimal to suspend operations because these take-or-pay provisions effectively convert a variable cost of selling coal to a fixed operating cost."[219]

Arch had a similar discussion:

> From time to time we enter into "take or pay" contracts for rail and port capacity related to our export sales. These contracts require us to pay for a minimum quantity of coal to be transported on the railway or through the port regardless of whether we sell and ship any coal. If we fail to acquire sufficient export sales to meet our minimum obligations under these contracts, we are still obligated to make payments to the railway or port facility, which could have a negative impact on our cash flows, profitability and results of operations.[220]

A Powder Basin coal producer explained to Platts in late 2015 that even if the Millennium Project (and other proposed Pacific Northwest coal terminals) had been available at the time, they would not be used when export market coal prices were low (as they were in 2015); exports are not profitable when prices are low, and consequently there will be unused terminal capacity:

> Permitting delays for the proposed $680 million coal export terminal project in Longview, Washington, could actually benefit coal producers as current market conditions would not likely support additional exports, a Powder River Basin producer said Friday.
>
> […]
>
> "To some degree, I believe these agencies and environmental groups are doing the coal producers a favor by not approving or supporting the approval of these terminals," the producer said. "If the terminals were already built and in operation, few, if any, would be exporting coal as current pricing wouldn't support it."
>
> […]
>
> "You're looking at a PRB transportation component alone of about $53/mt to Asia, the PRB source said. "Producers would basically have to pay Asian customers to take their coal […]."[221] [222]

Moreover, as Arch's CEO discussed in a Q1 2014 Earnings Call, Arch incurred port and rail fees, rather than export at larger loss:

> [W]e incurred a charge of $12.5 million in the first quarter related to minimum obligations on various port and rail commitments.
>
> Given the prevailing weak prices in the seaborne market for both thermal and metallurgical coal we believe it is appropriate to incur these costs rather than move coal into over supplied markets. Absent improvement in those markets, we would expect to incur comparable charges for the remainder of 2014. However over the long-term we believe that we will create substantial value for shareholders through increased participation in the seaborne coal trend.[223]

To date, there has also been limited export coal terminal capacity at West Coast ports facilitating access to Asian markets. But given the often weak competitive position of US suppliers in Asian markets (notably when prices are lower), the available terminal capacity (notably at ports in BC) has not been fully utilized.

In fact, US suppliers, with prior commitments (to ports and railroads) to enable Asian exports, have renegotiated to reduce/defer those commitments, including paying fees to avoid having to export.

Since mid-2016, prices in Asian coal markets have risen from very low levels. In response, there has been some resumption of US producers (and specifically PRB) exporting and planning to export to Asian markets. However, as discussed in Section 7.5.2, US thermal coal export volumes are expected to decline between now and 2040. And as discussed in Sections 7.7 9.4.2.2, existing port capacity should be sufficient to handle the limited volumes of US thermal coal exports that would be shipped from the West Coast.

7.5 Longer-Term Coal Market Projections Indicate Existing Structural Disadvantages Will Intensify

Longer-term coal market projections indicate that the existing structural disadvantages for PRB coal, identified in the previous section (7.4), will only intensify between now and 2040. Based on longer-term coal market projections (particularly the 2017 World Energy Outlook (WEO) from the International Energy Agency (IEA) and the 2018 Annual Energy Outlook (AEO) from the US Energy Information Administration (EIA)),[224] these structural advantages will intensify due to the follow factors:

- Coal exports are projected to decline in the more mature Asian economies (Japan, South Korea, China), but grow elsewhere in Asia (notably in Southeast Asia and India). Demand in Asia is shifting to be less proximate to Millennium and more proximate to competitors (notably Indonesia and Australia). (Section 7.5.1)

- WEO 2017 projects that the global market for coal exports has peaked and will decline over the long term. Thermal coal export volumes in 2040 are 5% below volumes in 2016. Because of their higher costs, US exporters have a declining portion of this declining market with export volumes in 2040 projected at 25% below volumes in 2016. AEO 2018 further projects that only a small portion of US exports will be thermal coal to Asia. Put simply, neither the IEA nor the EIA projects that there will be a high volume of US thermal coal exports to Asia. (Section 7.5.2)

- According to WEO 2017, one of the large-scale shifts in the global energy system is the rapid rise and falling costs of renewables and other clean energy technologies. This explosive growth spells the end of the global coal boom. Growth in renewables is expected to accelerate, while growth in coal slows. (Section 7.5.3)

- The IEA and other energy analysts have begun to take these large-scale shifts in the global energy system into account. However, there is typically a lag in most mainstream economic projections. At the time the Millennium Project was investigated and proposed (2009-2012), market conditions appeared to be more favorable for exports. However, because of the lag in updating of long-term projections, an analysis based on currently available projections may still provide an overly optimistic economic outlook for Millennium. The shifts in the global energy system are large, rapid, ongoing and possibly accelerating. Hence, the long-term outlook for US coal exports may continue to worsen. (Section 7.5.4)

7.5.1 Coal Exports to Decline in More Mature Asian Economies but Grow Elsewhere in Asia

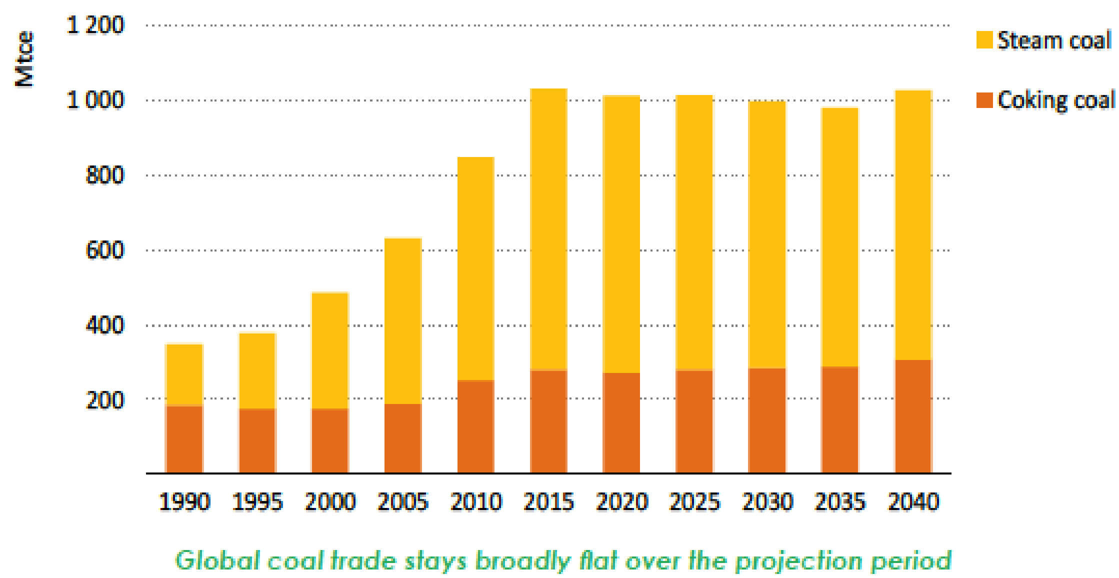
As summarized above, according to the IEA, coal exports will decline to the more mature Asian economies (Japan, South Korea, China), but will grow elsewhere in Asia (notably in Southeast Asia and India). Demand in Asia is shifting to be less proximate to Millennium and more proximate to competitors (notably Indonesia and Australia). Therefore, the structural disadvantages (distance and transportation costs, presence of more proximate suppliers and the quality of PRB coal) are intensified. Moreover, even if these structural disadvantages could be overcome, the growth projected in the emerging Asian markets is highly uncertain.

7.5.1.1 Shift in Asian Coal Imports

WEO 2017 explains that global coal trade has more than tripled over the past 25 years, but has begun to fall and is expected to decline out to 2040. Underlying this shift from rapid growth to decline are stark regional contrasts with imports declining in most markets, but still projected to grow in emerging markets in other developing Asia:

> In the past 25 years, coal trade has more than tripled. It fell by 4% in 2015, but is estimated to have rebounded slightly in 2016. In the New Policies Scenario coal trade does not grow, with trade volumes in 2040 still below 2015 levels [Figure 16 in this report].[225] In overall terms, the age of rapid expansion in coal trade is over. However, the global trend masks stark regional variations and some differences between types of coal.

Figure 16: WEO 2017 Global Trade by Coal Type (New Policies Scenario)



Source: Figure 5.4, IEA World Energy Outlook 2017, p. 215.

<u>Over the Outlook period, coal imports decline in advanced economies like the European Union, Japan and Korea. They also decline in China, which in 2016 was the biggest coal importer in the world</u>. Imports continue to play an important balancing role during China's coal industry restructuring process, but this process is assumed to be largely accomplished by the mid-2020, and China's need for coal imports therefore declines. By 2040, Chinese coal imports have dropped to 70 Mtce, down from nearly 200 Mtce in 2016 […].

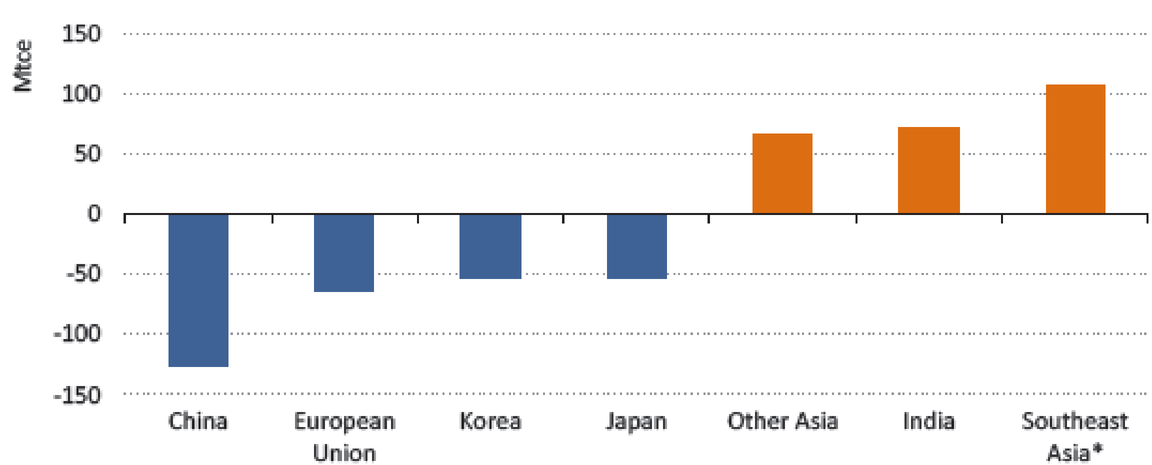
<u>The declines are offset by increases in other parts of the world, notably South and Southeast Asia</u>. In India, imports, currently in decline, are expected to pick up again from the early 2020s and increase through to 2040 [...] reaching over 235 Mtce in 2040 – a 45% increase over 2016 import levels […]. Similarly, fast growing and price sensitive economies like Viet Nam, Philippines, Malaysia, Thailand and Pakistan increasingly turn to the international coal market to meet their energy needs.

[…]

> <u>Steam coal has dominated the expansion of coal trading over the past 25 years and now accounts for more than 70% of trade. This pattern changes over the Outlook period, with coking coal trade growing by 0.2% per year while steam coal trade declines</u>.[226]

Figure 17 (Figure 5.9 in WEO 2017) illustrates the stark regional contrasts in the way coal imports change between 2016 and 2040; coal imports decline in advanced economies (European Union, Japan and Korea) as well as China, but these declines are offset by increases elsewhere, notably in emerging markets in other developing Asia (including Southeast Asia and "Other Asia").[227]

Figure 17: WEO 2017 Projected Change in Net Coal Imports by Region, 2016-2040



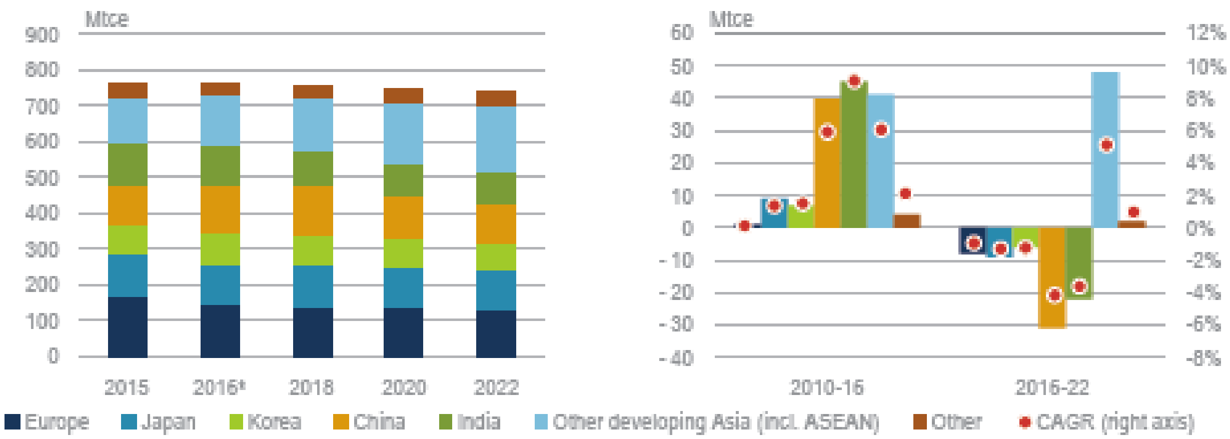
There are stark regional contrasts in the way coal imports change between 2016 and 2040

*Southeast Asia excludes Indonesia.

Source: IEA World Energy Outlook 2017, Figure 5.9, New Policies Scenario, net coal imports, p. 226.

IEA Coal 2017 provides additional detail regarding the ongoing shifts away from coal imports. As shown in Figure 18, IEA Coal 2017 projects that thermal coal imports will decline from 2016 to 2022, falling by about 3.5% (in Asia and worldwide). This is a big change from the 2010 to 2016 period when overall imports grew rapidly.

Figure 18: Projected Seaborne Thermal Coal Imports



* Estimated.

Notes: CAGR = compound annual growth rate. ASEAN = Association of Southeast Asian Nations.

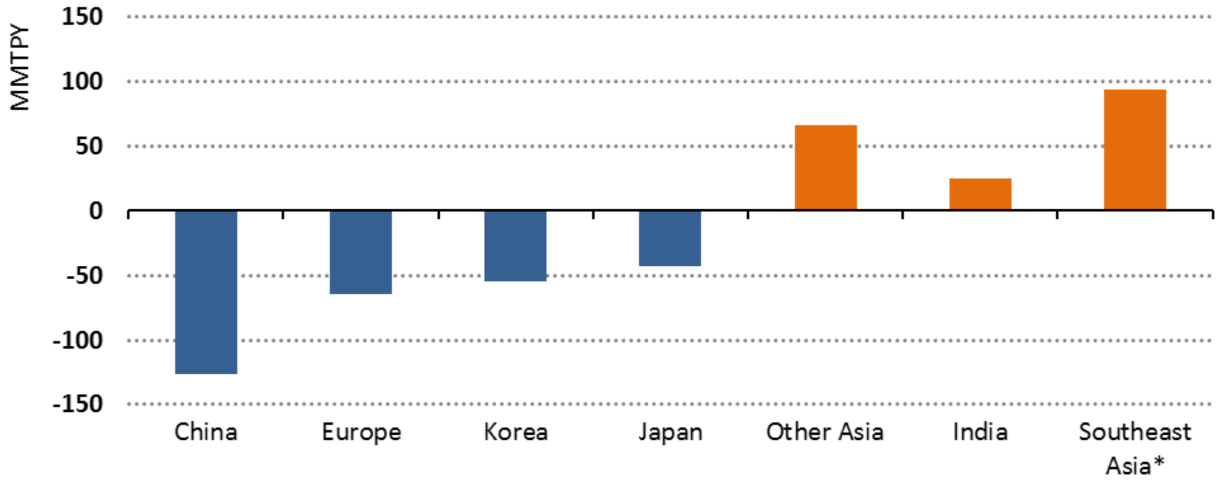
Source: IEA Coal 2017, Figure 4.2, p. 101.

As also shown in Figure 18, IEA Coal 2017 projects that imports will decline from 2016 to 2022 in most Asian markets, as well as in Europe; this decline will only be partly offset by strong growth in imports to emerging markets in other developing Asia. Once again, this a big change from the 2010 to 2016 period, when imports grew in markets across Asia. There was especially rapid growth in China, India, and emerging markets in other developing Asia, but there was also some growth in mature Asian markets (Korea and Japan).

The analysis in this report is oriented to the Millennium Project and to the extent possible provides data to facilitate comparison with Millennium (44 MMTPY thermal coal throughput at Full Build-Out Operations). The data in Figure 17 and Figure 18 are expressed as Mtce units.[228] The data in Figure 17 are for all coal imports (including metallurgical coals, as well as thermal coal) whereas the data in Figure 7 are specifically for thermal coal imports. For various import markets, 1 Mtce of total (thermal and metallurgical) coal imports corresponds approximately to 0.8 to 1.0 MMTPY thermal coal imports.

Figure 19 restates the data in Figure 17 in terms of MMTPY of thermal coal.[229]

Figure 19: WEO 2017 Projected Change in Thermal Coal Imports by Region, 2016-2040



*** Southeast Asia excludes Indonesia**

Source: IEA World Energy Outlook 2017, Figure 5.9, p. 226; IEA Coal 2017, pp. 39, 134; and TGG calculations.[230]

A comparison of Figure 17 and Figure 19 confirms that the projected change in thermal coal imports (MMTPY) is generally very similar to the projected change in total imports (Mtce). The major difference is that the growth in imports to India is much smaller for thermal coal than for total (including metallurgical coal); WEO 2017 projects that the growth in imports to India will be mainly (three-quarters) metallurgical coal, rather than thermal coal. Put more simply, India is not projected to be a major growth market for thermal coal imports.

Figure 19 shows that major growth in thermal coal imports is confined to emerging markets in other developing Asia, including Southeast Asia and Other Asia; there is also small growth in thermal coal imports to India. The projected growth in these emerging Asian markets (about 160 MMTPY from 2016 to 2040) is not enough to offset the large declines elsewhere in Asia (about 224 MMTPY in Japan, Korea, and China). Hence, thermal coal imports to all of Asia are projected to decline by about 30 MMTPY.

Meanwhile, thermal coal imports to Europe are projected to decline by about 65 MMTPY from 2016 to 2040. Thermal coal imports to all of Asia and Europe are projected to decline by about 104 MMTPY.

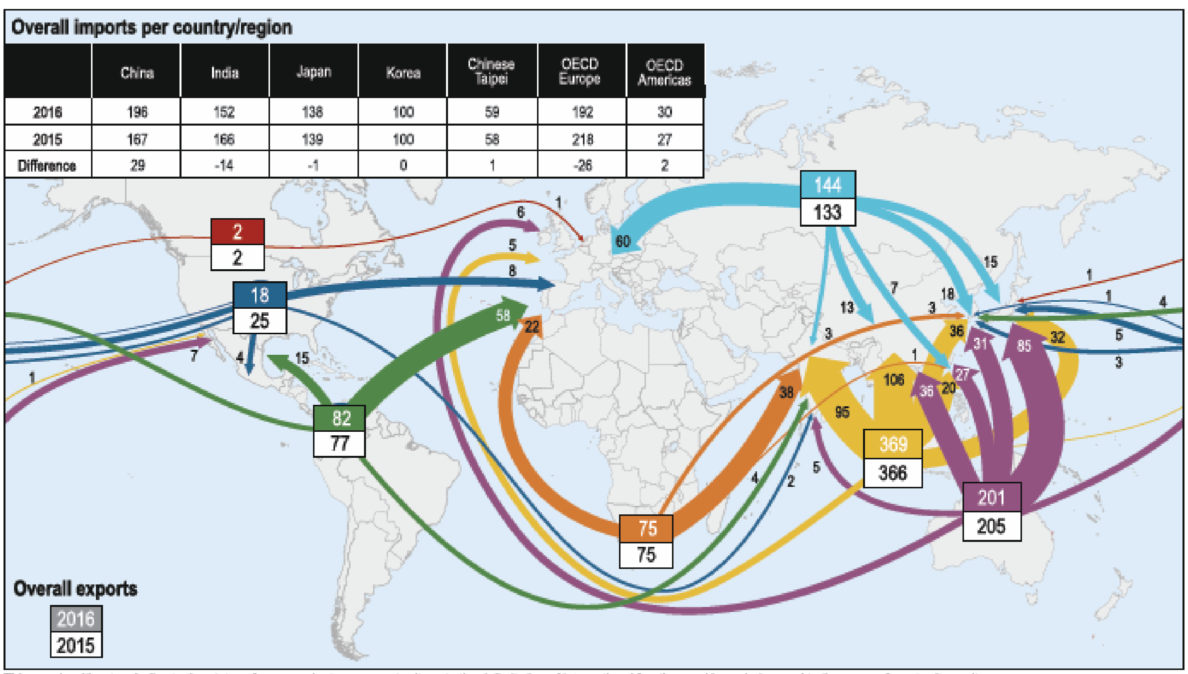
Hence, as further demonstrated in Section 8.1, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market will shrink by about:

- 224 MMTPY in Asian markets more proximate to Millennium (Japan, Korea, and China)
- 39 MMTPY in all of Asia
- 65 MMTPY in all of Europe
- 104 MMTPY in all of Asia and Europe.

7.5.1.2 Interactive Market Dynamics Among Suppliers to Asian Markets

Figure 20 and Figure 22 illustrate the trade flows in the global thermal coal market for 2016 and 2015, respectively. The arrows are color-coded to represent each major exporter. Figure 21 represents the thermal trade flows between major exporting and importing regions for 2016. Together, these figures provide a good visualization of the trade flows in the global seaborne thermal coal market.

Figure 20: Map: Main Trade Flows in the Seaborne Thermal Coal Market, 2016



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Note: Exports from Russia to Europe include exports via railway.

Source: IEA Coal 2017, Map 2.1, p. 39.

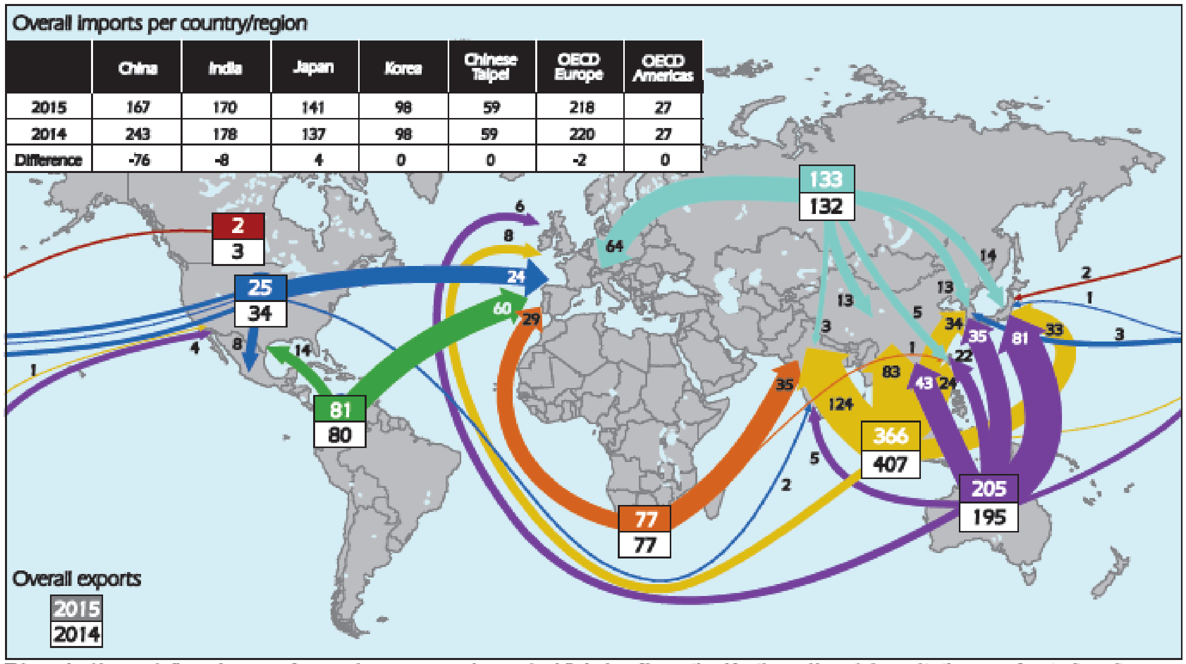
Figure 21: Thermal Coal Exports in 2016 (MMTPY) and Net Changes from 2015 (color-coded)

From \ To	China	India	Japan	Korea	Chinese Taipei	OECD Europe	Other Asia	Other	TOTAL
Indonesia	106	95	32	36	20	5	60	14	369
Australia	36	5	85	31	27	6	14	-3	201
Colombia	0	3	0	4	0	58	0	16	82
United States	0	2	5	1	0	8	0	0	18
South Africa	0	38	0	3	1	22	9	4	75
Russia	13	3	15	18	7	60	9	19	144
Other	40	7	2	6	4	32	2	28	121
TOTAL	196	152	138	100	59	192	94	79	1010

-30 Mt 0 +30 Mt

Source: IEA Coal 2017, Table 2.1, p. 39.

Figure 22: Map: Main Trade Flows in the Seaborne Thermal Coal Market, 2015



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Note: Exports from Russia to Europe include exports via railway.

Source: IEA Medium-Term Coal Market Report 2016, Map 2.1, p. 41.

Cloud Peak has indicated that the most important factor affecting thermal coal export markets is growth in overall Asian demand for seaborne coal; conditions in individual markets are less important. Exports of PRB coal will most likely go to the most proximate Asian markets (notably Japan and South Korea, but may sometimes go to less Asian proximate markets (such as Vietnam).[231]

TGG agrees that global thermal coal markets (and other global commodity markets) are highly interactive, such that market conditions and pricing in more proximate markets are affected by less proximate markets (and vice versa). So even if little (if any) exports via Millennium (and existing ports in BC) go to less proximate markets (such as India), exports to the more proximate markets are more likely if market conditions are favorable in less proximate markets. For example, if coal demand in India increases, Indonesian coal may go to India instead of South Korea, and in turn more US coal may go to South Korea.

Physical commodity flows are of key importance, but there can be important linkages between markets even without physical flows. That said, transport costs are of key importance for dry bulk commodities, and these costs are a particularly important competitive factor for thermal coal. Especially for PRB coal, transport cost comprises the majority (and for exports to Asia, the large majority) of delivered cost (total costs as delivered to customers). Put another way, it costs more to transport PRB coal (from the mine to customers) than it does to mine the coal.

These economic fundamentals affect the competitive position of various suppliers to various markets, both short- and long-term. Coal demand and imports in Asia are shifting away from mature markets (notably Japan and South Korea) that are more proximate (for coal via Pacific Northwest ports) to emerging markets (further south and west in Asia, such as Vietnam and India) that are less proximate. This shift favors competing suppliers (notably Indonesia and Australia) that are more proximate to these emerging markets.

US coal exports via Pacific Northwest ports are already "structurally disadvantaged," i.e., they have higher transport costs to even the most proximate Asian markets (notably Japan and South Korea). US exports are competing with Asian suppliers that are closer to and have lower costs to supply these emerging markets.[232] Nonetheless, when export market prices have been cyclically high, it may have sometimes been profitable to export coal via Pacific Northwest ports to these more proximate markets.

But US coal exports via Pacific Northwest ports have a structural disadvantage (higher transport costs) that is further compounded with respect to the less proximate emerging Asian markets (such as Vietnam and India). Compared with Japan (or Korea), these markets are further from the Pacific Northwest and even closer to Indonesia (and Australia). So the extent these less proximate markets require coal imports, they are likely to come from the more proximate Asian suppliers.

The market dynamics identified by Cloud Peak (e.g., if more coal from Indonesia goes to India instead of South Korea, more US coal may go to South Korea) may occur short-term, especially <u>if</u> Indonesia does not have available capability to supply both India <u>and</u> South Korea). But longer term, if there are markets in both India and South Korea that can be profitably supplied from Indonesia (or from other lower-cost suppliers, notably Australia), producers in Indonesia (or elsewhere) will likely provide this supply (including making required investments to maintain and expand production).

7.5.1.3 Structurally Advantaged Competitors Have Lower Risks

To the extent that coal producers are structurally advantaged (notably have costs lower than competitors) to supply certain markets, they have strong incentives and lower risks to supply these markets. As Cloud Peak itself has noted elsewhere, lower cost producers (notably Indonesia) will be competitive and will export under a wide variety of market conditions (notably, as export market prices fluctuate due to cyclical factors, but also under a wide range of long-term price trends).[233] Put simply, lower cost producers will be able to export whether prices are high or low.

A discussed in Section 7.3 on the Economics of Swing Supply, higher cost producers will only be competitive to export when prices are higher. Hence, higher cost producers have high risks if they make large investments to enable exports that may only be profitable under highly favorable market conditions (notably, when and if export market prices are higher due to cyclical factors and/or favorable long-term price trends). In particular, US PRB coal producers have high risks if they make large investments to enable expanded exports to Asia. As explained in Section 6.3.2, Arch Coal lost over $240 million seeking to develop exports to Asia and had to undergo Chapter 11 bankruptcy. And as explained in Section 5, Millennium and Lighthouse are low-value and high risk.

Indonesia is not a homogenous coal producer. Indonesian coal production includes both lower and higher cost production; so Indonesia can provide swing supply as well as lower cost non-swing supply. According to WEO 2017:

> Indonesia has a diverse coal industry. There are some large companies with access to low cost coal deposits which achieve considerable economies of scale and produce some of the least-cost coal available to the international market […]. However, many operations are small and have higher costs: during times of high prices they tend to increase output and exports rapidly. […]
>
> Indonesia may well keep its newly acquired role of swing supplier in the Asia-Pacific market and temporarily ramp up production to benefit from price volatility. It remains relatively easy in Indonesia to open new coal mines, bring idled coal mines back online and ramp up production at existing facilities.[234]

In general, a rise in Asian coal demand and imports is favorable for exports via Millennium. But any benefit to Millennium is reduced if this rise in demand and imports is in Asian markets less proximate to Millennium. Moreover, , overall Asian coal demand will not be rising substantially and seaborne imports will be flat or declining. And within that overall flat or declining market for exports, demand will be shifting from markets more proximate to Millennium to those less proximate.

7.5.2 Global Market for Coal Exports has Peaked and Will Decline over the Long-Term

WEO 2017 projects that the global market for coal exports has peaked and will decline over the long term. Thermal coal export volumes in 2040 are 5% below volumes in 2016. Because of their higher costs, US exporters have a declining portion of this declining market with export volumes in 2040 projected at 25% below volumes in 2016. AEO 2018 further projects that only a small portion of US exports will be thermal coal to Asia (7 MMTPY in 2025 and 11 MMTPY in 2038). These projections are less than 25% of the Project's capacity of 44 MMTPY at full throughput. Moreover, these projections include US exports to Asian markets (notably India) that are typically via East and Gulf Coast ports. Put simply, neither the IEA nor the EIA projects that there will be a high volume of US thermal coal exports to Asia.

7.5.2.1 AEO 2018 Projections

AEO 2018 projects that US coal exports will remain relatively flat from 2020 onward, at levels generally below the peaks in recent years.[235] As has been the case historically, these exports will be mainly metallurgical coal.[236] Only a small portion will be thermal coal to Asia (7 MMTPY in 2025 and 11 MMTPY in 2038).

AEO 2018 projects that Asia will overall be a large and growing destination market for seaborne coal exports.[237] But there will be some shifts, with projected exports declining to Japan and China, and growing elsewhere in Asia (notably to India, but also to South Korea, Taiwan, and Southeast Asia). The US is projected to supply only about 1% of Asian thermal coal imports. As has been the case historically, Indonesia and Australia will be the principal exporters of thermal coal to Asian markets, supplying over 75% of the total. Southern Africa will supply another 10%.[238]

7.5.2.2 WEO 2017 Projections

WEO 2017 projects that the global market for coal exports has peaked and will decline over the long-term.[239] Thermal coal export volumes in 2040 are 5% below volumes in 2016. But US exporters, with relatively high costs, would have a declining portion of this declining market, such that US export volumes in 2040 are 25% below volumes in 2016.

WEO 2016 discussed the declining market for US coal exports and the bleak prospects for US West Coast exports in particular:

> […] net coal shipments from the United States have been in steep decline for three consecutive years, falling to an estimated 53 Mtce in 2015, just over half the historical highs of around 100 Mtce. This declining trend is set to continue over the projection period […] Opportunities to place coal on the international market are increasingly limited for US producers. If the

> projected decline in Chinese imports is realised (and bearing in mind the difficulties of building export infrastructure), the prospects of exporting larger quantities of coal from the US west coast are bleak [...][240]

Based on AEO 2018 and WEO 2017 (as well as 2016), port capacity will not be a major constraint on US coal exports and specifically thermal coal exports to Asia. AEO 2018 and especially WEO 2017 project coal export volumes, which are generally below the peak volumes in recent years, and which have been achieved via existing ports and other logistics.

It should be understood that historical and projected US thermal coal exports to Asia include exports to India and other countries (such as Pakistan and Thailand), which are not proximate to West Coast ports.[241] Exports to these markets are typically via ports on the US East and Gulf Coast.

The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. Based on AEO 2018 and WEO 2017, the US will not export large volumes of thermal coal to Asia because supply from the US will not be generally economically competitive in destination markets.

7.5.2.3 Limited Niche for US Thermal Coal Exports

Even if US thermal coal is not generally economically competitive in Asian markets, there could be some exports in some years when prices are high owing to cyclical factors and other shorter-term market fluctuations. There may also be some niche for US thermal coal to provide diversity of supply.

According to the US EIA:

> Coal buyers (importing regions) tend to spread their purchases among several suppliers to reduce the impact of potential supply disruptions, even though this may add to their purchase costs.[242]

In Cloud Peak's comments on Millennium DEIS, CPE indicated the following:

> U.S. coal exports offer East Asian power plants additional energy security through supply diversity […] Nevertheless, U.S. coal exports must be competitively priced to access East Asian customers [243]

To the extent there is limited niche market for US thermal coal exports to Asia (and more specifically PRB coal to North Asia via Pacific Northwest (PNW) ports, notably when coal market prices are sometimes atypically high and/or for diversity of supply for buyers}, this limited niche market is not well matched to Millennium (a very large new facility that would handle only thermal coal). Instead, this type of limited niche market is much better matched to port alternatives, notably Westshore (an existing facility with metallurgical coal as baseload).

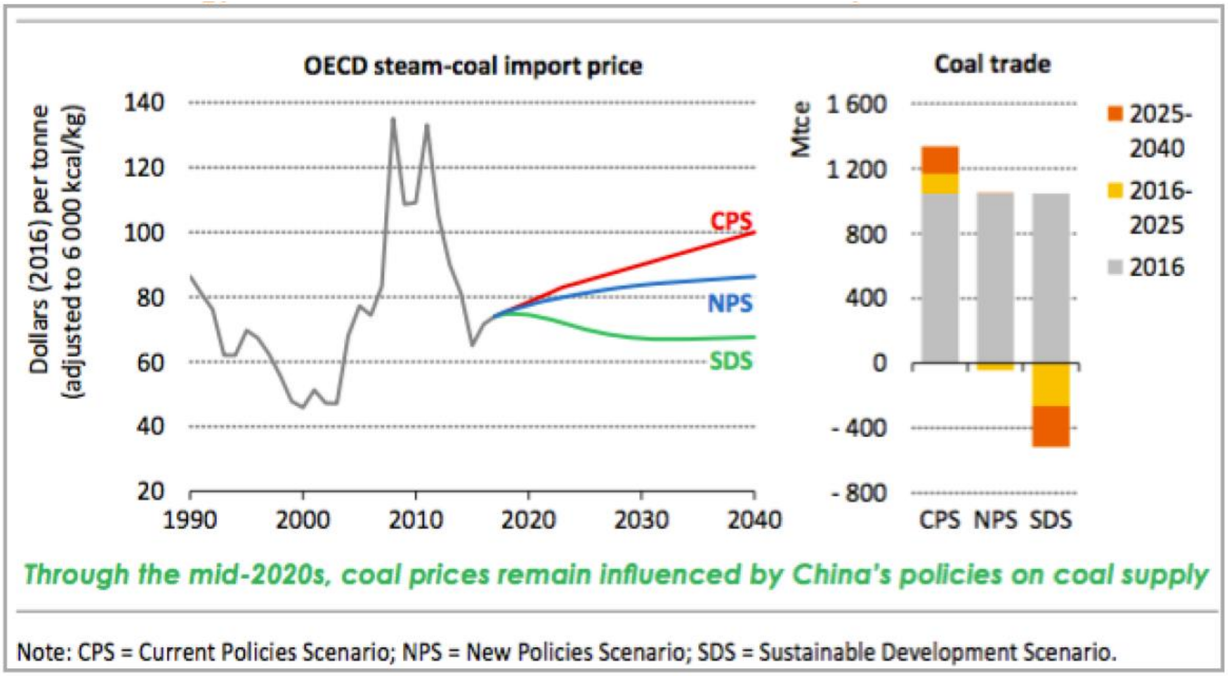
7.5.3 Rapid Rise and Falling Costs of Renewables and Other Clean Energy Technologies and Decline in New Capacity Additions for Coal

In recent years, the global energy sector been undergoing dramatic shifts that are large, rapid, ongoing, and possibly accelerating. According to WEO 2017, one of the large-scale shifts in the global energy system is the rapid rise and falling costs of renewables and other clean energy technologies. This explosive growth spells the end of the global coal boom. Growth in renewables is expected to accelerate, while growth in coal slows. Another major shift identified in WEO 2017 is a shift to a cleaner energy mix in China.[244] As we have discussed above, other mature Asian economies (e.g. South Korea and Japan) are also shifting to a cleaner energy mix.

Between 2017 and 2040, renewables are projected to be the large majority of net capacity additions for electricity generation. Additions of new coal plants, which would result in more favorable market conditions for exports via Millennium, are projected to be much lower going forward than in recent years. Renewables are expected to continue to outstrip coal in net new capacity additions, as net coal capacity additions continue to decline.

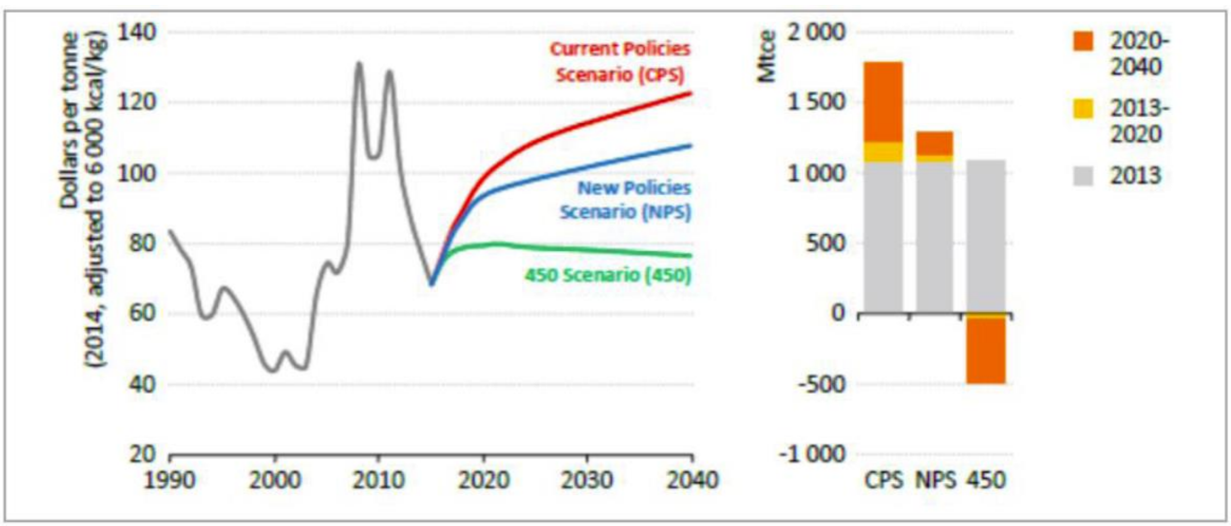
7.5.3.1 Dramatic Shifts in Energy Sector and Deterioration of Market Conditions for Coal

Figure 23: WEO 2017 Thermal Coal Price Projection by Scenario



Source: Figure 5.2, IEA World Energy Outlook 2017, p. 209.

Figure 24: WEO 2015 Thermal Coal Price Projection by Scenario



Source: Figure 7.3, IEA World Energy Outlook 2015, p. 274.

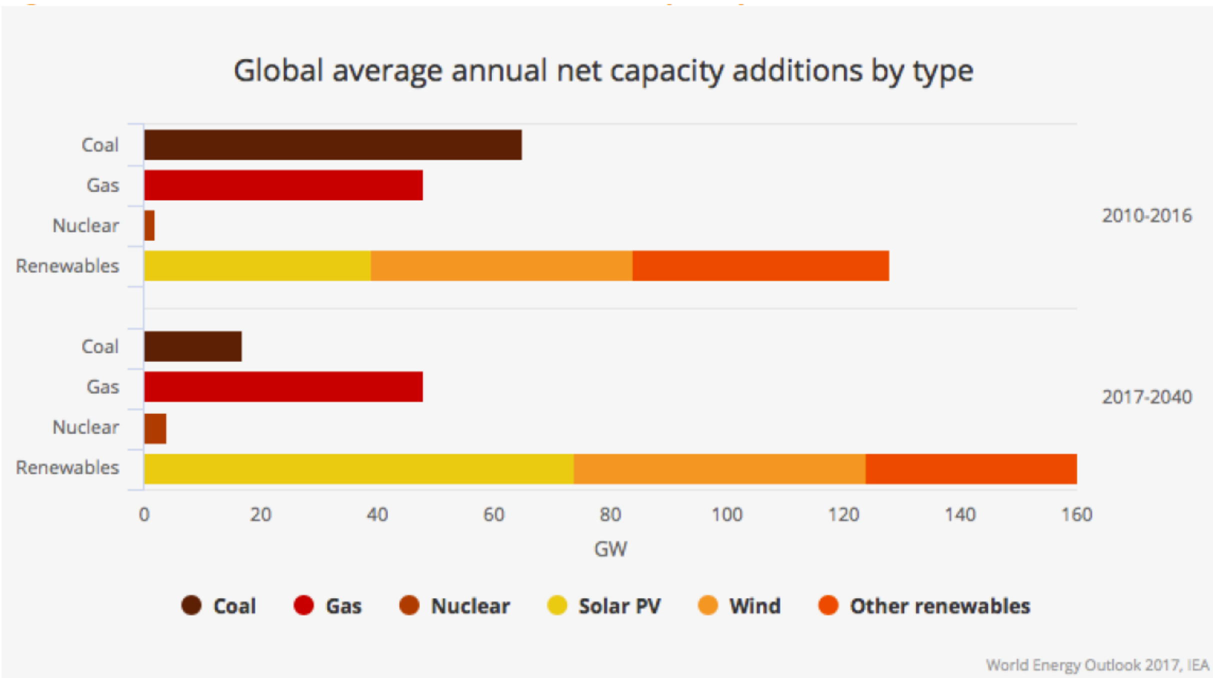
Export market coal prices are a key driver for exports via Millennium; with lower prices, exports will not be profitable, and little if any coal would actually be exported via Millennium.

As is typical in energy market analysis, WEO estimates long-term market prices for coal (and other energy commodities) based on supply and demand.[245] Supply and demand are balanced, via prices based on marginal supply costs: the costs of the most expensive supply sources required to supply demand. Prices rise as more supply is required, because more expensive supply sources are required. Higher demand enables higher prices, and higher prices enable higher supply. Likewise, lower demand results in lower prices.

These dynamics are illustrated by the results in WEO 2017 (Figure 23) and WEO 2015 (Figure 24). Each Figure provides thermal coal price projections, which vary by scenario. Compared with the New Policies Scenario, coal demand, coal trade volumes, and coal trade prices are lower for the Sustainable Development Scenario (in WEO 2017) and the 450 Scenario (in WEO 2015). Likewise, coal prices vary between WEO 2017 and WEO 2015. The global coal trade is projected to shrink in WEO 2017 rather than expand as was projected in WEO 2015. And as a result, export market coal prices are lower in WEO 2017 compared with WEO 2015.

7.5.3.2 Decline in New Capacity Additions for Coal While Renewables Continue to Grow

Figure 25: Historical (2010-2016) and Projected Annual Net Capacity Additions (2017-2040)



Source: IEA World Energy Outlook 2017, Figure 6.6, p. 244. Figure 6.6 data are shown here as average annual net additions (additions minus retirements); “Other renewables” includes hydro.

As shown in Figure 25, between 2017 and 2040, renewables are projected to be the large majority of net capacity additions for electricity generation. Additions of new coal plants, which would result in more favorable market conditions for exports via Millennium, are projected to be much lower going forward than in recent years. Renewables are expected to continue to outstrip coal in net new capacity additions, as net coal capacity additions continue to decline.

According to WEO 2017, one of the large-scale shifts in the global energy system is the rapid rise and falling costs of renewables and other clean energy technologies:

> *Renewables step up to the plate; coal strikes out*
>
> **Compared with the past twenty-five years, the way that the world meets its growing energy needs changes dramatically in the New Policies Scenario, with the lead now taken by natural gas, by the rapid rise of renewables and by energy efficiency.** Improvements in

> efficiency play a huge role in taking the strain off the supply side: without them, the projected rise in final energy use would more than double. Renewable sources of energy meet 40% of the increase in primary demand and their explosive growth in the power sector marks the end of the boom years for coal. Since 2000, coal-fired power generation capacity has grown by nearly 900 gigawatts (GW), but net additions from today to 2040 are only 400 GW and many of these are plants already under construction. In India, the share of coal in the power mix drops from three-quarters in 2016 to less than half in 2040. In the absence of large-scale carbon capture and storage, global coal consumption flatlines.[246]

Renewables already make up the majority of net capacity additions for electricity generation and they are expected to continue to be the large majority of net capacity additions from now until 2014. According to WEO 2017:

> Renewables capture two-thirds of global investment in power plants as they become, for many countries, the least-cost source of new generation. Rapid deployment of solar photovoltaics (PV), led by China and India, helps solar become the largest source of low-carbon capacity by 2040, by which time the share of all renewables in total power generation reaches 40%. In the European Union, renewables account for 80% of new capacity and wind power becomes the leading source of electricity soon after 2030, due to strong growth both onshore and offshore. Policies continue to support renewable electricity worldwide, increasingly through competitive auctions rather than feed-in tariffs, and the transformation of the power sector is amplified by millions of households, communities and businesses investing directly in distributed solar PV. […][247]

> **rapid deployment and falling costs of clean energy technologies**; in 2016, growth in solar PV capacity was larger than for any other form of generation; since 2010, costs of new solar PV have come down by 70%, wind by 25% and battery costs by 40%.[248]

The explosive growth in renewables spells the end of the global coal boom. Coal exports are expected to decline to the more mature Asian economies (Japan, South Korea, China), but even in Southeast Asia, strong growth in coal remains uncertain according to WEO 2017:

> Southeast Asia is often accepted as an undisputed growth engine for coal demand, but public opposition against coal projects – mostly on environmental grounds such as concerns about local air pollution – is

growing. Coal's main advantage in Asia, its cost-competitiveness, is challenged by the falling cost of renewables and, to an extent, by low-cost LNG, so strong growth cannot be taken for granted here either.[249]

7.5.4 Lag in Long-Term Energy Projections Implies Long-Term Outlook for US Coal Exports May Continue to Worsen

The IEA and other energy analysts have begun to take these large-scale shifts in the global energy system into account. However, there is typically a lag in most mainstream economic projections. At the time the Millennium Project was investigated and proposed (2009-2012), market conditions appeared to be more favorable for exports. This perception was based on the Asian coal boom, which was heavily influenced by China's economic growth, starting in the mid-1990s. China's coal imports are now expected to decline significantly (64%) between now and 2040 as China's energy system shifts away from coal. However, because of the lag in updating of long-term projections, an analysis based on currently available projections may still provide an overly optimistic economic outlook for Millennium. The shifts in the global energy system are large, rapid, ongoing and possibly accelerating. Hence, the long-term outlook for US coal exports may continue to worsen.

In recent years, the global energy sector been undergoing dramatic shifts that are large, rapid, ongoing, and possibly accelerating. Of key relevance to global coal prices and trade are the rapid deployment and falling costs of clean energy technologies, as well as a shift to a cleaner energy mix in China and other mature Asian economies (e.g. South Korea and Japan). While the WEO projections have begun to take these dramatic shifts into account, there is typically a lag in the WEO's projections, and as it the case with most mainstream economic projections.

Evidence of this lag can be seen in the significant difference in the WEO 2015 and the WEO 2017 Thermal Coal Price Forecast by Scenario (Figure 23 and Figure 24 above). The WEO 2015 CPS and NPS prices are high and increasing over time, whereas the WEO 2017 CPS and NPS prices grow much more slowly. In the WEO 2015 the long-term coal prices in 2040 were projected at over $105/ton for the NPS and over $120/ton for the CPS. In the WEO 2017 however the projections have been revised downward by a significant amount such that long-term coal prices in 2040 were projected at about $85/ton for the NPS and about $100/ton for the CPS: an approximate 20% decrease in the 2040 prices. This lag is significant for several reasons.

First, export market coal prices are a key driver for exports via Millennium; with lower prices, exports will not be profitable, and little if any coal would actually be exported via Millennium. WEO 2015 projected that export market coal prices would be increasing and relatively high over the long-term; hence, long-term market conditions would be improving and somewhat favorable for exports via Millennium. WEO 2017 projected that export market coal prices would be flat and relatively low over the long-term; hence, long-term market conditions would be unfavorable and unlikely to substantially improve for exports via Millennium.

Second, it is possible and even likely that future projections will be even less favorable for exports via Millennium. Recent projections are less favorable than previous projections, and this trend is likely to continue, as long as forecasts lag the rapid shifts away from coal. In particular, compared with current available projections, future projections may and likely will be lower for thermal coal exports, in terms of both volumes (MMTPY) and prices ($/tonne), for destination markets in Asia and worldwide.

The lag is also shown in Figure 23 and Figure 24 above, in terms of Coal trade (export volumes) being much lower in WEO 2017 than in WEO 2015. In the New Policies Scenario (NPS), Coal Trade is projected to

- decline by about 4% in WEO 2017, from 2016 to 2040 (Figure 23); vs.
- grow by about 19% in WEO 2015, from 2013 to 2040 (Figure 24).

Likewise, in the Current Policies Scenario (CPS), Coal Trade is projected to

- grow by about 28% in WEO 2017, from 2016 to 2040 (Figure 23); vs.
- grow by about 64% in WEO 2015, from 2013 to 20140 (Figure 24).

There is the possibility of a continuing lag in the WEO thermal coal price and volume projections if energy sector shifts continue to accelerate (and likely an even greater lag in the EIA's AEO projections). So, it is fair to say that the WEO may still be a lagging indicator of emerging shifts in coal markets (and the AEO is likely currently a lagging indicator). At some point in the future, conditions may begin to stabilize, and projections may catch up to more fully reflect emerging future realities. But for now, and quite possibly for at least the next few years, each new projection (from the WEO and especially the AEO) will reflect major changes from the year before, but the next year's forecast will reflect even more change.

7.6 Export Drivers are Cyclical

7.6.1 Volatile and Cyclical Global Coal Prices and Boom-Bust Cycles

As explained above in Section 7.5, US coal exports from PRB face important long-term economic challenges that are projected to intensify. Coal exports are also subject to shorter-term fluctuating markets conditions that are highly uncertain and variable. Since 2006, coal prices have been highly volatile and cyclical, accompanying repeated booms and busts. Prices have rapidly increased and dropped by a half (or more).

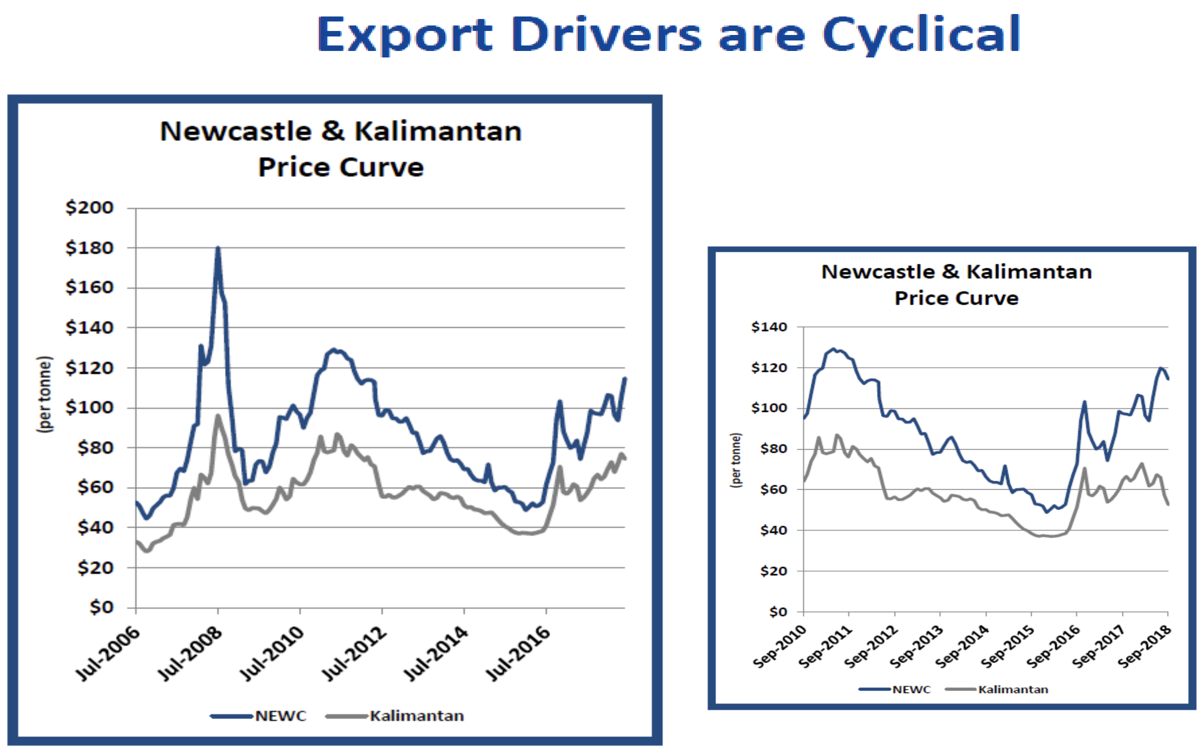
Boom and bust cycles are common in commodity markets and especially mining. A boom is characterized by a period of rising demand and high prices, leading to capacity expansion by suppliers (e.g. new mines, ports, etc.) premised on continued growth in demand and high prices. Boom turns to bust, as oversupply leads to lower prices and market downturns, which can be prolonged.

These wide price variations dramatically affect short-term profitability and losses, but do not reflect long-term economic fundamentals. As such, the IEA in its WEO publications ignores commodity market fluctuations and assumes that these markets will self-correct.[250] **Current relatively high coal prices should not be taken as an indicator of long-term favorable market conditions for Millennium.** The IEA along with industry observers agree that the recent price increases are short-term and not based on market fundamentals. WEO 2017 and other experts concur that the recent increase in coal prices is largely based on deliberate Chinese policies (starting in 2016) to restructure its coal industry (cutting capacity and managing production in order to avoid large lay-offs and a financial crisis from coal company bankruptcies). WEO 2017 projects that this industry restructuring will be largely accomplished by the mid-2020s, and China's coal imports will then rapidly decline.

Given boom and bust cycles in the commodity markets, as well as China's coal market intervention, it would be imprudent to infer that current high prices imply long-term potential for exports via Millennium.

In its July and October 2018 Investor Presentations, Cloud Peak Energy explicitly stated that export drivers are cyclical and provided supporting graphs (reproduced below as Figure 26). The graphs clearly show the high volatility and cyclical nature of coal prices since 2006. As explained in Section 7.3.2, PRB thermal coal is swing supply to the Asian coal markets. Export volumes are highly variable based on fluctuating market conditions. These market conditions are characterized by volatile and cyclical coal prices. TGG therefore agrees with CPE's conclusion that export drivers are cyclical.

Figure 26: Export Drivers are Cyclical



Source: Cloud Peak Investor Presentations: July 2018 (left), October 2018 (right) [251]

As indicated in the graphs above (and supported by data and analysis from Natural Resources Canada and US National Coal Council [252]), since 2006, coal prices been highly volatile and cyclical, making long-term coal production planning difficult. Prices have rapidly increased and then dropped by a half (or more). In a 12-year period (2006-2018), there have been repeated booms and busts:

- boom in 2006 to mid-2008: prices spike upward, to peaks three (or more) times higher than in 2006;
- bust in later 2008: prices drop by half (or more);
- boom in 2009 to 2011: prices rebound and roughly double;
- bust in later 2011 through 2015: prices drop by more than half, to a trough lower than in last bust (late 2008);
- boom in 2016: prices rebound and roughly double.

In 2017-2018, pricing trends have diverged for the Australian and Indonesian coal price benchmarks. For the Kalimantan Indonesian lower quality coal price benchmark, prices have been between fluctuating but overall level; prices remain substantially below the peaks in 2011. But for the Newcastle Australian higher quality coal price benchmark, prices in 2017 and 2018 drop and then rebound to levels approaching peaks in 2011.[253]

As explained in Sections 4.3 and 4.4, thermal coal includes a wide diversity of coal types and properties. Thermal coal is primarily used to generate electricity in power plants. These power plants are typically designed, configured, and operated to use coal with specific characteristics. There is typically some (but limited) flexibility for using coal with a range of characteristics.[254]

Hence, specific markets for thermal coal (such as for exports via Millennium) are to some extent granular (differentiated and specialized based on the characteristics of coal produced by individual mines and used in individual power plants). But there is typically a substantial amount of linkage between specific markets, such that pricing for coal with various characteristics are related and move together. Put simply, favorable market conditions typically result in higher prices in various specific markets for coal with various characteristics; likewise, unfavorable market conditions result in broadly lower coal prices. Nonetheless, as demonstrated by recent market conditions, there can be divergence (especially shorter-term) in price trends for

7.6.2 Profitability of Exports

Coal prices in Asian export markets fluctuate over a wide range as shown in Figure 26.

- PRB exports are not profitable when coal prices are low, but can be profitable when coal prices are high.
- Decisions on whether to export are also affected by fixed costs, notably commitments to ports and railroads.
- Coal prices were especially low in 2015-16, and Cloud Peak paid large reservation fees (to Westshore and BNSF) rather than export at a greater loss.
- Prices have since increased and are now relatively high, enabling some PRB exports to Asia to resume.
- Cloud Peak reports that exports to Asia from Spring Creek were profitable starting in late 2017; cash margins were $5/ton or less (for Q4 2017, Q1 2018 and Q2 2018 periods where results have been disclosed in SEC/investor filings). But coal prices have risen recently, so margins could be higher currently.
- The future of coal markets is highly uncertain (both short- and long-term).
- Various forecasts predict that currently high Asian coal prices will decline over the next few years and stay relatively low long-term. If prices are low, it will not be profitable to export coal to Asia from PRB via Millennium (and Westshore).

> But there could be periods and niches where exports are more viable (e.g., when coal prices are higher; if buyers seek diversity and security of supply; if the type of coal from PRB and other western US sources is a good match for certain power plants).

Potential profit (net revenues) to coal producers from exports is a function of revenues and costs:

Profit ($) = revenue ($) – costs ($).

Potential revenue to coal producers from exports is a function of price and volume:

revenue ($) = price ($/tonne) * volume (tonnes).

Potential costs to coal producers from exports is also function of price and volume:

costs ($) = unit cost ($/tonne) * volume (tonnes).

Export market pricing is highly cyclical, volatile and uncertain, and fluctuates over a wide range. Meanwhile, especially for the coal producers that might export via Millennium, costs to supply Asian markets are sizable and less variable than export market pricing, and involve take-or-pay commitments.

There are a variety of pricing arrangements for thermal coal exports to Asian markets.[255] Many transactions occur on spot markets, negotiated a short time in advance for purchases of short duration. But annual (or longer) contracts are common in certain markets, notably Japan. Pricing for spot transactions is typically based on benchmark coal prices. Pricing for annual (or longer) contracts is commonly tied to (or at least correlated with) benchmark coal prices. Hence, revenues to coal producers is based on evolving export market pricing.

Based on investor disclosures, it typically costs Cloud Peak around $60/metric ton to produce Spring Creek coal, transport it by rail and load it onto a ship at Westshore. After several years of losses when Asian coal prices were low, exports were reported to be profitable starting in Q4 2017 as Asian coal prices increased. In this recent period (Q1 2017 through Q3 2018), revenue from Cloud Peak exports was around $60-65/tonne, so the cash margin on exports was about $6/tonne or less.

Very recently in 2018, coal prices in Asian markets have further increased to levels last seen in 2012. But over the next few years, prices are forecast to decline and remain relatively low long-term. With lower prices in Asian markets, exports of thermal coal from Power River Basin (and other western US sources) may no longer be profitable.

In Cloud Peak's Earnings Conference Call on Q3 2018 Results, CEO Colin Marshall explained that Kalimantan coal prices (and specifically the Kalimantan 5000 index) had dropped below $55/tonne, so cash margins on experts were expected to be minimal in Q4 2018:

> The recent drop in the Kalimantan 5000 index means that margins will be minimal in Q4 unless there is a near term increase in pricing. […] Newcastle index prices have remained above $110 per metric ton; though there has been a drop in the Kalimantan 5000 index, which is currently below $55 per metric ton.

Put more simply, on a cash basis, Cloud Peak exports are now about break-even.[256]

The actual level of utilization of Millennium is highly uncertain. Project operations will be driven by the market and customer demands. Thus, operations will be affected by the ongoing evolution of coal markets and could be both highly uncertain and variable.

Consequently, and especially in a situation where thermal coal exports (from Western US to Asia) are in a weak competitive position, utilization of the Project may be at low (or even zero) levels. But at some other times, utilization could be at higher levels.

Japan and South Korea are key markets for potential exports via Millennium. And the potential for exports via Millennium is also affected other Asian markets, including China, Taiwan, India, and Southeast Asia. These key markets and drivers will be further analyzed in Section 8.

The IEA's Coal 2017 projects thermal coal imports for Japan and Korea will decrease significantly over the next few years. Imports to Taiwan are projected to increase, but the effect is small.[257] Overall imports to Asia markets are also projected to drop. Declining Asian demand will put downward pressure on prices and will likely particularly affect US exports for the reasons discussed in Sections 7.3 and 7.5:

- the US is swing supplier;[258]
- coal exports are projected to decline in the more mature Asian economies (Japan, South Korea, China), but grow elsewhere in Asia (notably in Southeast Asia and India); demand in Asia is shifting to be less proximate to

Millennium and more proximate to competitors (notably Indonesia and Australia).

The weak competitive position of US thermal coal exports to Asia and the Project was well summarized by a Wood Mackenzie coal market expert in February 2016:

> **Planned US coal ports: a swift trip from vital to irrelevant**
>
> Three short years ago, the conventional wisdom was both that growing thermal coal demand in Asia couldn't be met by regional suppliers, and that low-cost coal from the US would fill the breech. Several new coal ports, notably in Oregon and Washington, were already in the early stages of permit approval, hoping to help fill this void.
>
> The intervening three years have made clear what a miscalculation this was. Opposition to the major projects – Gateway Pacific, Millennium and Port Morrow – has been effective, led by a broad coalition of environmental groups, tribal nations and local and national governments. But as challenging as this was for port developers, the larger problem has been economic.
>
> […] To sell coal in Asia, […] PRB producers must now outcompete Indonesian producers for existing market. And in the new coal price paradigm, they cannot.
>
> PRB coal is produced at very low operating costs, typically in the range of US$10-15/t FOB mine. But exporting this coal requires an inland railroad transport of 2,000 km to the northwest Pacific coast […] and […] costs […] at least US$30/t […]. With port and ocean freight costs included, delivered PRB costs are well above those of Indonesian producers. Three years ago, this was not the case.
>
> […] This remarkable shift in competiveness [sic] follows the rapid deceleration in the market price of coal, itself largely a result of declining growth in demand. Making matters worse for the PRB, future demand in Asia will continue growing less robustly than in the past. Negative netback PRB margins will persist. […]
>
> The popular rise of non-coal alternatives, supported by policy and regulation, continues to slow growth in coal demand. […]
>
> Building new Pacific Northwest coal ports, once seen as essential, is now viewed as nothing more than a risky long-term bet.[259]

Energy experts from PA Consulting Group and Hellerworx described the shifts in the competitiveness for PRB coal since 2008; and how Cloud Peak chose to pay BNSF and Westshore not to export in 2014:

> Western coal exports of PRB coal was a burgeoning business in 2008. No US coal ports had been built to handle PRB coal, so it was mostly shipped through Vancouver ports. In 2014, Cloud Peak indicated that it was going to pay contractual liquidated damages to BNSF and Westshore terminals for its failure to meet minimum volume commitments rather than make shipments at the prevailing depressed market prices. In late 2016, Cloud Peak resumed shipments when markets improved.[260]

In a November 2015 report on the US coal industry (Downsizing the US coal industry: Can a slow-motion train wreck be avoided?), the influential management consulting, McKinsey & Company, described competitiveness challenges for US Coal Exports after the boom years of 2008-2012. The report is pessimistic about the future of US seaborne coal exports.

> **Seaborne coal markets: A gloomy outlook for US exports**
>
> US thermal and metallurgical coal is relatively high cost compared with production in the rest of the world. In the boom years of 2008 to 2012, when prices spiked for both coal types, the United States was able to significantly expand exports. Markets in 2015 are very different, with Chinese imports of thermal and metallurgical coal in steep decline. This is pushing the major suppliers to the seaborne market—Australia for metallurgical and thermal coal, and Indonesia for thermal coal—to compete on price. The stronger dollar puts US producers at a further disadvantage.
>
> […] Plans have been considered to boost exports from the Powder River Basin, but railroad bottlenecks and the insufficiently competitive position of its relatively low-calorific-value coal in global markets might present obstacles.[261]

In 2017, Forbes also reported on the challenges faced by US thermal coal as swing suppliers to the Asian export markets with intermittent demand.

> Thermal coal miners could look overseas for investors and markets as the realities of shrinking domestic demand will continue to hurt the industry.

> But even offshore, they will face competition from coal producers in Australia and other locales closer to Asian markets.
>
> "Historically, the US has been a swing producer for coal internationally," said Bob Burnham, an industry consultant, in a presentation at last week's National Western Mining Conference in Denver. On the conference sidelines, he said there's no immediate reason to think that would change. The demand is there for coal in Asia, but the demand is intermittent, making it difficult for a company to plan for it.
>
> "If we could get the production needs to level out, that would help," he said.[262]

7.7 Port Alternatives

7.7.1 Introduction

Based on AEO 2018 and WEO 2017 (and earlier versions of these projections), port capacity will not be a major constraint on US coal exports and specifically coal exports to Asia. Projected coal export volumes are generally below peak volumes in recent years, which have been achieved via existing ports and other logistics.

Several existing ports/logistics can and do provide alternatives to Millennium for the export of PRB coal. These include Westshore Terminals (Metro Vancouver, BC); Ridley Terminals (Prince Rupert, BC); and ports on the US Gulf Coast and Great Lakes. Westshore, in particular, is a good nearby substitute for Millennium enabling sizable volumes of PRB exports when market conditions are favorable. By itself, Westshore has capacity for approximately 11 MMTPY of PRB exports. And together with Ridley, BC terminals could provide even more West Coast export capacity for PRB coal.

7.7.2 Millennium

7.7.2.1 Large, High-Volume, Dry Bulk Commodity Facility

The Project would be a large, high-volume dry bulk transloading facility handling coal. The throughput for the Project is large relative to other existing coal export terminals in US and Canada, and large relative to Millennium's existing bulk terminal and other bulk commodity exports from ports in Washington and Oregon (Section 7.7.2.2).

Coal is a dry bulk commodity.[263] Dry bulk commodities are minimally processed raw materials and typically have a low-value (relative to their weight and volume). These commodities are handled (including transport and storage) in large unpackaged volumes. Handling of dry bulk commodities is typically highly mechanized/automated, with a low labor intensity (few jobs per volume handled).[264] This low labor intensity helps to reduce costs to increase the economic viability of handling and transporting low-value dry bulk commodities.[265]

The Project would be a transloading facility, transferring commodity (coal) unloaded from one transport mode (rail) to be loaded onto another transport mode (ocean-going vessels). The Project would also include on-site coal storage, providing a buffer between receipt and send-out of coal.

7.7.2.2 Project is Larger than Other Terminals

At Full Build-Out Operations, the Millennium Project would have a throughput of 44 MMTPY (million metric tons per year) of coal[266] and 1.5 million metric tons of on-site coal storage.[267] As shown in Table 1, the Project would be larger than any of the existing coal export facilities in North America (US and Canada). These existing facilities mainly export higher value metallurgical coal. As explained earlier, the Project would export lower-value thermal coal. [268]

The Project would be much larger than the coal handling at the existing Millennium bulk terminal. The existing terminal is used to bring in relatively small quantities of coal by rail.[269] This coal is stored in existing silos and then transferred by truck to the neighboring Weyerhaeuser wood products manufacturing complex, where it is used to provide energy.[270] Under current permits and zoning, the existing bulk terminal is allowed to transport and store up to 150,000 metric tons of coal per year (0.15 MMTPY).[271] With current activities, coal throughput at the existing terminal may be close to (or possibly exceed) this permit limit.[272]

Coal transport and storage at the Project would be in addition to any coal handled as part of ongoing operations at the existing bulk terminal.[273] With current activities, the existing bulk terminal has coal throughput that is well under 1% (and likely under 0.5%) of throughput at the Project. Put another way, the Project would result in over 120 times (and likely over 300 times) more coal being transported (and stored) than at the existing bulk terminal.

According to the FEIS, coal throughput at the existing bulk terminal was planned to increase considerably, to more than 0.65 MMTPY.[274] This amount would be substantially in excess of the 150,000 metric tons of coal (0.15 MMTPY) allowed under the current permits and zoning. But even if coal throughput at the existing bulk terminal substantially increases, it would still be less than 2% of throughput at the Project.

By itself, the Project would export more tonnage of dry bulk commodities than all of the existing marine terminals in Washington (and in Oregon on the Columbia River), combined.[275]

7.7.3 Westshore

7.7.3.1 Overview

The second largest existing North American coal terminal is Westshore Terminal in Roberts Bank, Metro Vancouver, BC, less than one mile north of the US border (Washington). The capacity of this terminal is a throughput of 33 MMTPY, estimated to increase to 35 MMTPY in 2019.

Table 5 provides Westshore data and analysis for 2010-2017. It should be understood that Table 5 provides the basis for the entirety of Section 7.7.3, but in the interest of brevity it will not be repeatedly referred to.

Table 5: Westshore Terminal (Statistical Profile, 2010-2017)

		Units	2010	2011	2012	2013	2014	2015	2016	2017
[1]	**Throughput Capacity**	MMT	**27.0**	**27.0**	**27.0**	**33.0**	**33.0**	**33.0**	**33.0**	**33.0**
	Coal Shipments									
[2]	Metallurgical	MMT	16.4	15.8	16.0	18.1	18.8	19.4	19.3	17.8
[3]	Thermal	MMT	8.2	11.3	9.8	11.7	11.5	9.1	6.3	11.0
[4]	Petroleum Coke	MMT	0.1	0.2	0.3	0.3	0.3	0.3	0.2	0.2
[5]	**TOTAL**	MMT	**24.7**	**27.3**	**26.1**	**30.1**	**30.6**	**28.8**	**25.8**	**29.0**
[6]	**Ships handled**	vessels	**246**	**277**	**270**	**285**	**300**	**258**	**234**	**287**
	Revenues									
[7]	Coal Loading	CAD$000	218,644	205,627	232,442	286,703	303,819	319,653	287,152	322,199
[8]	Other	CAD$000	4,892	7,210	8,253	9,022	8,256	46,164	37,311	7,832
[9]	**TOTAL**	CAD$000	**223,536**	**212,837**	**240,695**	**295,725**	**312,075**	**365,817**	**324,463**	**330,331**
	Expenses									
[10]	Wages	CAD$000	N/A	N/A	N/A	N/A	106,200	115,880	115,046	130,313
[11]	Port Lease	CAD$000	18,533	20,248	19,663	21,601	21,701	20,992	19,594	21,082
[12]	Depreciation	CAD$000	21,934	10,042	9,870	11,528	10,549	10,463	13,380	17,034
[13]	Other	CAD$000	N/A	N/A	N/A	N/A	9,638	10,964	10,995	11,322
[14]	**TOTAL**	CAD$000	**137,648**	**115,522**	**130,589**	**145,388**	**148,088**	**158,299**	**159,015**	**179,751**
[15]	Operating	CAD$000	112,149	105,832	120,638	132,159	133,497	143,548	143,904	164,784
[16]	Administrative	CAD$000	25,499	9,690	9,951	13,229	14,591	14,751	15,111	14,967
	Employees (at year-end)									
[17]	Non-union	Persons	26	30	30	35	40	40	36	39
[18]	Unionized	Persons	179	181	183	188	200	207	415	421
[19]	**TOTAL**	Persons	**205**	**211**	**213**	**223**	**240**	**247**	**451**	**460**
[5]/[1]	**Capacity Utilization**	%	**91%**	**101%**	**97%**	**91%**	**93%**	**87%**	**78%**	**88%**
[5]/([6]*1000)	**Cargo Size (Coal per Ship)**	kMT	**100**	**99**	**97**	**106**	**102**	**112**	**110**	**101**
	Labor intensity (employees per million metric ton:									
[18]/[1]	**of Throughput Capacity)**	Persons	**7.6**	**7.8**	**7.9**	**6.8**	**7.3**	**7.5**	**13.7**	**13.9**
[18]/[5]	**of Coal Shipments)**	Persons	**8.3**	**7.7**	**8.2**	**7.4**	**7.8**	**8.6**	**17.5**	**15.9**
	Revenue per metric ton of shipments									
[7]/([5]*1000)	Coal Loading	CAD$	8.85	7.53	8.91	9.53	9.93	11.10	11.13	11.11
[8]/([5]*1000)	Other	CAD$	0.20	0.26	0.32	0.30	0.27	1.60	1.45	0.27
[9]/([5]*1000)	TOTAL	CAD$	**9.05**	**7.80**	**9.22**	**9.82**	**10.20**	**12.70**	**12.58**	**11.39**
	Coal Loading	USD$	8.59	7.62	8.91	9.25	8.99	8.68	8.40	8.56
	Other	USD$	0.19	0.27	0.32	0.29	0.24	1.25	1.09	0.21
	TOTAL	USD$	**8.79**	**7.88**	**9.23**	**9.54**	**9.23**	**9.93**	**9.49**	**8.77**
	Expenses per metric ton of shipments									
[14]/([5]*1000)	Total	CAD$	**5.57**	**4.23**	**5.00**	**4.83**	**4.84**	**5.50**	**6.16**	**6.20**
		USD$	**5.41**	**4.28**	**5.01**	**4.69**	**4.38**	**4.30**	**4.65**	**4.77**

Units: MMT: Million Metric tons; kMT: Thousand Metric tons; data annual unless noted.

Source: Westshore Annual Reports and Annual Information Forms, full sources and notes in endnote.[276]

Westshore Terminal mainly handles metallurgical coal. As explained in Section 4.6, Westshore is proximate to Western Canadian metallurgical coal production,[277] which is transported by rail to the terminal. Westshore is also proximate to destination markets in Asia.

As shown in Table 5, Westshore metallurgical coal shipments have been relatively stable, with shipments around 19 MMTPY (but these decreased to 16 MMTPY in 2010-2013 during the recovery from the Great Recession).

Westshore also handles smaller volumes of thermal coal from Western US (notably Montana) production. Compared with metallurgical coal, thermal coal shipments have been more variable. Since 2010, thermal coal shipments have ranged from 11-12 MMTPY in high years (including 2017) to 6.3 MMTPY in the lowest year (2016).

In required disclosure to investors and Canadian Securities regulators in 2017, Westshore explains that:

- shipments are generally under long-term contracts;
- contracts with US thermal coal producers include:
  - Cloud Peak and Lighthouse;
  - Global Sales Group (see Table 3 ranked #21), which owns Signal Peak Mine in Montana (see Table 4, ranked #29);
- contracts with Canadian metallurgical coal producers include Teck (19 MMTPY, comprising over half of overall shipments at Westshore):

> Westshore generally operates under long-term contracts with its customers. Westshore’s agreement with Teck extends to March 31, 2021 and commits Teck to ship 19 million tonnes per contract year at fixed rates. Westshore expects that Teck will ship most of the remaining coal from its mines through Neptune. Teck announced on February 14, 2018 plans to spend $85 million during the year to increase capacity at Neptune.
>
> Westshore's contracts with U.S. thermal coal producers have different expiry dates. Its agreement with Cloud Peak Energy Inc. (“Cloud Peak”) expires at the end of 2020 and its other agreements with U.S. thermal coal producers extend beyond 2020. The current agreement with Cloud Peak requires minimum payments in each year of the contract. Under its contract, Global Sales Group, LLC must ship a minimum annual volume each year, with the option to increase such annual volume within prescribed amounts at fixed rates with the potential for increases to the rate based on the price of coal achieved by the customer.

> In 2016, Westshore entered into a long-term shipping contract with LHR Coal Marketing, LLC ("Lighthouse"), a U.S. thermal coal producer. Pursuant to this agreement, Lighthouse is required to ship minimum volumes in 2017 and 2018, with an option to increase such volumes within prescribed amounts, and provides for fixed shipment volumes at fixed rates thereafter.[278]

7.7.3.2 Westshore Capacity Available for US Thermal Coal (notably PRB) Exports

Westshore has been in service since 1970 and is currently undergoing a major modernization program. When this program is completed in 2019, annual throughput capacity is estimated to rise from 33 MMTPY to 35 MMTPY. [279]

As shown in Table 5, Westshore thermal coal shipments have ranged up to 11.7 MMTPY. And as explained in Section 6.4.3, Cloud Peak has now contracted for 9.5 MMTPY (10.5 MMst) of port capacity in 2021-2022. In addition to Cloud Peak's PRB exports, Westshore is being used for exports by Lighthouse, as well as exports from other Montana (non-PRB) producers.

Meanwhile, as explained in Section 7.7.4, capacity is being expanded at another BC terminal (Neptune, like Westshore located in Metro Vancouver BC); the Neptune expansion provides additional port capacity for PRB exports at Westshore, because the expansion of Neptune will enable a larger share of metallurgical coal exports to be shipped via Neptune, rather than via Westshore.

Given all of the factors described above, from 2020 onward, Westshore will likely have capacity for more than 11 MMTPY of exports by Cloud Peak and other PRB producers. This estimate is consistent with the Tongue River EIS, which estimated that Westshore would have 6-12 MMst per year of capacity available for PRB exports.[280]

7.7.3.3 Westshore vs. Millennium

As shown in Table 1, Westshore has very deepwater access and therefore can accommodate Capesize vessels.[281]

For exports of US thermal coal, the Project may offer somewhat lower rail costs than Westshore because of geographic proximity, but this would be largely, if not completely, offset by higher ocean shipping costs.

For the rail routings assumed in the FEIS, the Project is somewhat more proximate to US thermal coal production in the Powder River and Uinta Basins. So compared with Westshore, the Project could have an advantage in terms of shorter distance and thus somewhat lower rail costs.[282] But even the Project's proximity advantage may be at least partially offset by the capability to accommodate longer unit trains at Westshore.[283]

Coal unit trains access Westshore via a recently upgraded rail corridor connecting with the major rail links to Western US and Canadian coal production.[284] Westshore can handle the longer (150-plus car) unit trains now being used (notably by BNSF) to transport coal.[285] There has been a long-term upward trend in train lengths at Westshore.[286]

Furthermore, as indicated above, the Project has higher ocean shipping costs than Westshore. As shown in Table 1, the Project has relatively shallow berthage on the Columbia River, which limits vessel size to Panamax vessels.[287] Especially for high-volume, longer-distance routings (notably between North America and Asia), larger Capesize vessels are more cost-efficient.[288] As also shown in Table 1, the berthage at Westshore is very deep and can accommodate Capesize vessels.[289] Likewise, coal export terminals in Australia and Indonesia (which are competitors with Westshore and the Project) can accommodate Capesize vessels.[290]

The FEIS assumes that exports from Westshore would use Panamax vessels and that ocean shipping costs would be similar for Westshore and the Project.[291] However, data for Westshore confirm that exports via Westshore typically utilize larger Capesize vessels, such that average cargo size is increasing. In fact, the average cargo size at Westshore has now increased to twice the average cargo size estimated for the Project.[292]

With Stage 2 Full Build-Out Operations, Millennium could load up to 44 MMTPY onto 840 ships per year (or about 52,380 metric tons per ship).[293] Meanwhile, PRB thermal coal exports via Westshore are loaded onto much larger vessels, averaging over 120,000 metric tons per ship.[294]

Exports via Westshore that use the more cost-efficient Capesize vessels would have lower ocean shipping costs than exports via the Project that use Panamax vessels. This lower ocean shipping cost would largely, if not completely, offset any advantage that the Project has over Westshore in terms of rail costs.[295]

More generally, Westshore has the advantage of being a well-established existing facility serving a sizable (and relatively stable) market for metallurgical coal from Western Canadian production. Thus, Westshore is likely well-positioned to compete for the limited amounts of US thermal coal exports to Asia that may sometimes be profitable.

As explained in Section 6.4 and shown in Figure 14, Cloud Peak Energy is the leading PRB coal exporter and continues to rely on Westshore to enable these exports. Cloud Peak has identified these key advantages for Westshore:

- existing, operating facility;
- lowest cost;
- deepwater port;
- Capesize vessels;
- Cloud Peak's long-standing, strong relationships with both Westshore and BNSF (for rail transport from Cloud Peak mines to Westshore).[296]

Cloud Peak has confirmed that recent agreements with the Westshore Terminal provide Cloud Peak with firm export capacity foundation for many years. Moreover, as part of these recent agreements, Westshore now has priority rights on throughput capacity for any Cloud Peak exports.[297] Put more simply, Westshore now has first call on any coal that Cloud Peak seeks to export.

In light of the above, TGG therefore concludes that overall transport costs via Westshore are likely similar to transport costs via Millennium.

7.7.3.4 Risk Factors for Westshore and Its Customers (Coal Exporters)

In required information provided to investors and Canadian securities regulators, Westshore identifies risk factors for itself and its customers. Westshore provides analysis of seaborne thermal coal markets that are highly cyclical, variable, and uncertain. As concluded by Westshore, it is not possible to meaningfully predict future coal prices in the short- or long-term:

> **RISK FACTORS**
>
> […]
>
> *Dependence on Coal Shipments*
>
> As a single purpose port facility, the biggest factors affecting Westshore's profitability are the volume of coal shipped by ts [sic] customers through the Terminal and the associated handling rates paid by Westshore's customers. The competitiveness of Westshore's customers, demand for their products and the volumes of coal they sell are affected by numerous factors beyond the control of Westshore or its customers, including the demand for coal, for steel and steel-based products, the availability of cost competitive coal supplies, the price of coal obtained by its customers, currency exchange rates, political and economic conditions, labour disruptions at mine sites or rail carriers, and production and transportation costs in major coal producing regions. Global demand for thermal coal may decline over time as a result of increasingly stringent environmental regulations and increasing pressure from environmental activists [sic]

> The effect of any or all of these factors on coal prices and export volumes is impossible for Westshore or its customers to predict with accuracy. Weak demand for the customers' products may result in lower throughput and lower revenues from which Westshore can cover its operating costs, a significant portion of which is relatively fixed. If realized coal prices fall below the full cost of production and transportation for any coal operations of Westshore's customers, they will experience operating losses and may decide to discontinue those operations for a period of time (or permanently), thus reducing the coal volumes shipped through the Terminal, which would be likely to have an adverse effect on Westshore's profitability. Weak thermal coal markets from 2014 to the first half of 2016 resulted in restructured agreements with two U.S. coal customers which reduced volumes and profitability in 2016. Coal prices have improved since the first half of 2016, however, it is not possible to predict future coal prices in the short or long term and any prolonged weakness or deterioration in thermal coal markets may have further adverse effects on those customers.[298]

In 2015 and 2016, coal producers (notably Cloud Peak) paid about $50 million in "reservation fees" to Westshore, to avoid exporting coal at a loss into weak markets.[299] These reservation fees included buyout payments from US coal producers restructuring contracts to reduce volume commitments, as well as shortfall payments under take-or-pay contracts where the coal had not been shipped.[300] In effect, US coal producers paid to avoid even bigger losses from exporting coal into a weak market.

7.7.4 Other BC (Ridley and Neptune)

Ridley in Prince Rupert, BC has a throughput capacity of 18 MMTPY and can load Capesize vessels.[301] Ridley handles both metallurgical and thermal coal, with shipments typically far below capacity. Hence, Ridley has in the past been used for US thermal coal exports (notably from PRB) and could have capacity for 8 MMTPY (or more) of PRB exports. The rail haul from PRB to Ridley is relatively long and high cost, but Ridley does have some offsetting advantages in terms of low congestion, capability to load Capesize vessels, and relatively short ocean shipping distances to North Asia. It is typically assumed and reported that PRB exports via Ridley have overall higher logistics costs than via other ports (such as Westshore).

Hence, Ridley may only be used for PRB exports to the extent that capacity is not available at other ports (notably Westshore) and prices in Asian destination markets are high enough to make exports via Ridley profitable.

Nonetheless, the availability of capacity at Ridley does provide some backstop and surge capacity for occasional market conditions when export volumes are high and highly profitable. Also, there is potential to shift exports of Canadian coal production from Westshore to Ridley, thus freeing up capacity at Westshore. Cloud Peak has in the past acquired export capacity at Westshore, by paying Westmoreland to export its Coal Valley Alberta thermal coal production via Ridley instead of Westshore.[302]

Neptune in Metro Vancouver, BC now has a throughput capacity of 12.5 MMTPY and in the process of being expanded (to increase throughput by about 50%. Neptune handles various bulk commodities including coal, potash and fertilizer. For various reasons, coal shipments via Neptune may be limited to metallurgical coal (as has been the case historically). Nonetheless, the Neptune expansion provides additional port capacity for PRB exports, because metallurgical coal exports are thus via Neptune, rather than Westshore.

7.7.5 US Gulf Coast

Exports via US Gulf Coast ports are an option for PRB coal, especially to some Asian markets (notably India) and for some PRB coal (notably from Wyoming Southern PRB which (compared with Montana PRB) is less proximate to Pacific Northwest ports and more proximate to US Gulf Coast.[303] Moreover, as explained below, Lighthouse (then known as Ambre) and other coal producers (notably Arch) were specifically involved in US Gulf Coast terminals in order to export PRB coal.

Ambre US Gulf Coast Terminal Projects (Port of Corpus Christi)

7.7.5.1

Ambre entered into a lease with Port of Corpus Christi in Texas, with plans to construct a new coal export terminal. Ambre eventually decided that this proposed terminal would not be viable and paid for early termination of the lease.

Ambre's Annual Report for year ended July 30, 2012 identified potential capability to export coal via the US Gulf Coast.

> During 2011-12, Ambre Energy's key operational and financial objectives are to:
>
> […]
>
> Apply for permits to build new state-of-the-art coal handling facilities at Millennium Bulk Terminals – Longview (Washington), Port of Morrow

(Oregon) and the Port of Corpus Christi (Texas) designed to service the export market

[…]

Ambre Energy secured options in May 2011 to lease land at the Port of Corpus Christi, Texas and Port of Morrow, Oregon. The Port of Corpus Christi lease was executed in October 2011, and both ports provide additional gateway options for accessing international markets.

[…]

We intend to work closely with our existing coal customers in the USA while increasing production to support the growing export markets, targeting the Asia-Pacific through our west coast infrastructure projects and meeting strong European demand via the Gulf of Mexico.

[…]

Gulf States Bulk Terminal, Port of Corpus Christi

In addition to Ambre Energy's west coast export options through Millennium Bulk Terminals-Longview and the Port of Morrow, it has increased its potential export capacity by securing a lease over land at the Port of Corpus Christi, Texas on the Gulf of Mexico.

The Port of Corpus Christi is the sixth largest port in the United States in total tonnage. Established in 1926, the port is equipped to receive Panamax vessels and handles a broad range of cargo including petroleum, ore, minerals, grain, chemicals and liquid bulk.

Ambre Energy subsidiary, AE Infrastructure, LLC, has a lease over a 14.5 acre tract in an area known as the Bulk Terminal in the Port's Inner Harbor. The lease gives Ambre Energy the option for a 30 year tenure and the capability to develop a storage site to receive and ship coal through the Port's joint facilities.

Three Class 1 railroads serve the Bulk Terminal, including BNSF, Kansas City Southern Lines (KCS) and UP. Of these railroads BNSF and UP serve the coal fields under investigation to potentially supply coal for export.

Ambre is currently engaged in the feasibility engineering process to design a coal storage facility and to determine the throughput capacity.

> Discussions are underway with current tenants at the port to develop a joint facility. The port's existing air emissions permits would allow immediate coal shipment up to 1.5 Mtpa and Ambre Energy is investigating options for increasing this tonnage, requiring new infrastructure and appropriate air permits for a larger scale operation. The Port of Corpus Christi presents an ideal opportunity for Ambre Energy to access South American and European markets for thermal coal.[304]

Then in 2013, Ambre paid Port of Corpus Christ for early termination of the lease for the Corpus Christi coal terminal project:

> In 2011, Ambre Energy North America Inc. signed a five-year lease (with five 5-year options) for 14.5 acres at the Bulk Terminal under the name of Gulf States Bulk Terminal, LLC. The lease obligated Ambre Energy to pay a base rent of $1,087,500 for the initial five years as well as $1,424,583.33 in throughput rent that would begin on January 1, 2015, and end on October 31, 2016 (end of the primary term). To date, Ambre has paid the Port $453,125 for the base rent and is current on their lease payments. They do not currently owe any throughput rent since that obligation does not start until January 1, 2015. The coal export market has dramatically declined in the last three years, and Ambre no longer considers a coal export terminal viable in this area. Ambre approached staff about an early termination of their lease obligation.
>
> Negotiations between Port staff, the Port's legal counsel, Ambre representatives and Ambre's legal counsel have resulted in Ambre's agreement to pay all of the base rent through the end of 2013 and a termination fee of $217,500 for base rent in 2014. The termination fee is equal to the base rent for the full 12-month period of 2014 and will be payable in installments of $18,125 due on the first day of each month. In the event the Port is able lease all or part of this property prior to December 31, 2014, the Port will credit any rent it receives against Ambre's termination fee obligation. The Port would also waive Ambre's obligation for payment of any throughput rent.[305]

7.7.6 Great Lakes and East Coast

Ports on the Gulf Coast and East Coast have been and could be used for exports of PRB and other Montana coal production.[306] These routings would not be likely used for exports to North Asia, but could be used for exports to South Asia (notably India), as well as to other destination markets (notably in Europe).

7.8 TGG's Evaluation of Potential for Coal Exports Via Millennium

In summary, based on WEO 2017 and AEO 2018, **the existing economic challenges and structural disadvantages for coal exports from the PRB will intensify. The major constraints on US exports are economic, as opposed to infrastructural or logistical limitations. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. Therefore, the longer-term outlook for exports via Millennium has significantly deteriorated since the Project was first proposed and may in fact continue to worsen.**

8 Key Export Markets and Drivers

8.1 Key Findings

Finding 1: Table 6 summarizes the results of calculations in Section 8 of the projected change in thermal coal imports by key market or market driver for exports from Millennium. The results of the table are also the basis of Figure 19 (from Section 7.5.1.1 reproduced here for ease of reference).

Table 6: Summary of TGG Calculations of Projected Change in Thermal Coal Imports by Region, 2016-2040

Key Market/Driver	2016 Imports	2040 Imports	Change 2016-2040
	(MMTPY)	(MMTPY)	(MMTPY)
Korea	100	45	(55)
Japan	138	95	(43)
China	196	70	(126)
India	152	177	25
Other Developing Asia = Other Asia + SE Asia	153	313	160
Europe	192	127	(65)
Korea + Japan	238	140	(98)
Korea + Japan + China	434	210	(224)
All Asia	739	700	(39)
Europe + Asian Market Drivers (China, India, Other Developing Asia)	693	687	(6)
All Asia + Europe	931	827	(104)

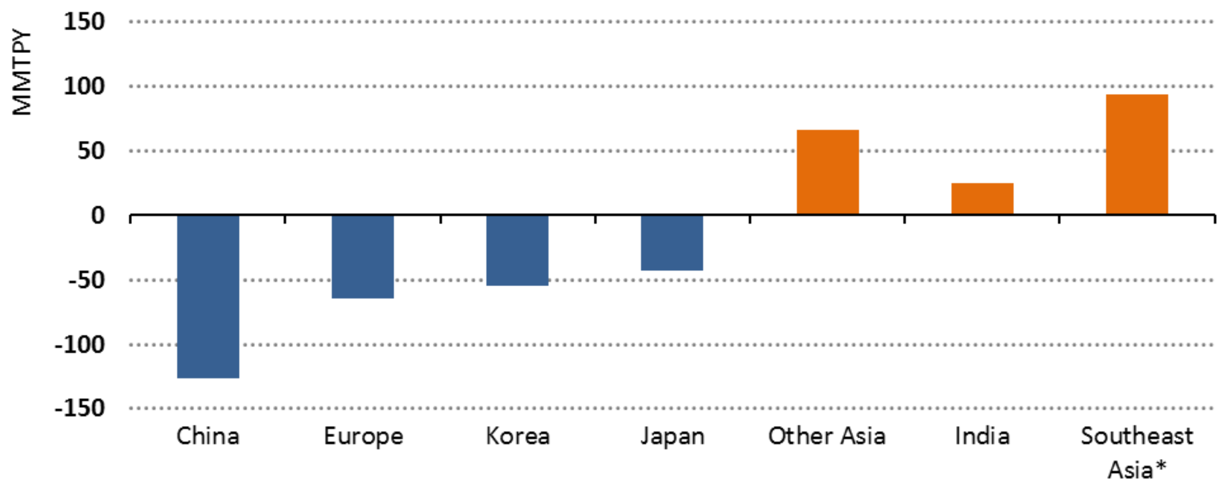
Note 1: Key Markets are in blue; Market Drivers are in green; Totals are in purple.

Note 2: Sources and detailed derivation of these projections are provided for each of the calculations in Section 8. See also endnote 307 for exact location of endnotes describing the calculations.

The projected growth in exports to other developing Asia (160 MMTPY) will be more than offset by the projected shrinkage (224 MMTPY) in exports to major Asian markets (Japan, Korea, and China). At a time when Millennium could export 44 MMTPY (at full throughput), thermal coal markets will shrink by approximately:

- 98 MMTPY in Millennium's key markets (Korea and Japan);
- 224 MMTPY in Asian markets most proximate to Millennium;
- 39 MMTPY in all Asian markets;
- 6 MMTPY in Key Market Drivers for Millennium (defined below as Europe, China, India and other developing Asia;
- 104 MMTPY in all Asian and Europe markets and drivers.

Figure 19: WEO 2017 Projected Change in Thermal Coal Imports by Region, 2016-2040



*** Southeast Asia excludes Indonesia**

Source: IEA World Energy Outlook 2017, Figure 5.9, p. 226; IEA Coal 2017, pp. 39, 134; and TGG calculations.[307]

(Sections 8.4 to 8.9)

Finding 2: The Asian markets that are shrinking are more proximate to Millennium and the markets that are growing are less proximate. This shift in demand intensifies the structural disadvantages for exports via Millennium. To the extent that growth in exports to other developing Asia (including Southeast Asia and Taiwan) results in favorable market conditions for exports, this will mainly benefit competing suppliers (notably Indonesia and Australia), rather than Millennium. (Sections 8.4 to 8.8)

Finding 3: The projected strong growth in coal exports to other developing Asia and modest growth in India are highly uncertain. The factors that have resulted in large shifts away from coal elsewhere in Asia are also reducing potential growth in coal exports to other developing Asia. (Sections 8.7 and 8.8)

The above Findings from this section are supportive of two of the seven overarching Key Findings of this report (Key Findings 3 and 5 from Section 1.1):

Key Finding 3: The Project is not needed to supply coal to Asia. Countries that could conceivably be served by exports from Millennium can easily meet their coal requirements from other sources, including Australia and Indonesia. The US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. (Sections 8.4 to 8.9)

Key Finding 5: US thermal coal exports face a number of economic challenges and structural disadvantages in the global markets, which are intensifying. These competitive challenges are unrelated to port capacity and will not be overcome by Millennium. (Sections 8.4 to 8.9)

8.2 Introduction

The analysis in Section 8 provides the detailed basis to support the following key findings in Section 7 (and particularly those in Figure 19):

- the potential for coal exports via Millennium is limited;
- market conditions will be unfavorable overall given the shrinkage of imports in most mature Asian markets, which may only be partially offset by growth in emerging Asian markets;
- uncertainty about growth in these emerging markets coupled with global shifts to renewables indicate ongoing evolution to even less favorable market conditions (more shrinkage in mature markets and less growth in emerging Asian markets).
- the likelihood of lags in mainstream economic projections at a time of global shifts implies that TGG estimates of shrinking Asian thermal coal imports (based on IEA projections) may still be overly optimistic.

The Complaint focuses on two countries (South Korea and Japan) as markets for coal via Millennium. Moreover, Lighthouse has some existing contracts to supply South Korea with PRB coal from the Decker Mine.

Likewise, this report identifies these large proximate Asian coal importers (South Korea and Japan) as key markets for US exports via Millennium. This report also identifies other coal importers as important drivers of market conditions for US exports via Millennium. The key drivers are China, India and other developing Asia (including Southeast Asia and Taiwan)[308], as well as Europe.

Thermal coal exports via Millennium are unlikely to be a competitive source of significant supply to these other coal importers (China, India, other developing Asia and Europe), identified as important drivers of market conditions for US exports via Millennium. Nonetheless, there are market linkages to Asian and global coal markets, such that a weaker market for coal imports in these Asian market drivers and Europe would be overall unfavorable for Millennium. More proximate competing coal suppliers can and do export to destination markets in both Asia and Europe. See Figure 19 to Figure 22.

With weaker markets for coal imports in the Asian market drivers, competing coal supply is pushed towards key Asian markets (i.e. South Korea and Japan). Likewise, with weaker markets for coal imports in Europe, competing coal supply is pushed towards Asian markets. As discussed above, the US is a swing supplier to global coal markets, and particularly to Asian thermal coal markets where supply from the US is structurally disadvantaged; competing suppliers are more proximate and have lower costs to supply these markets. **Hence, with weaker markets for coal imports in the Asian market drivers and Europe, markets for US exports to South Korea and Japan will also be less favorable, especially for exports via Millennium.**

Section 8.3 explains how TGG selected the key markets and market drivers to be analyzed. Sections 8.4 to 8.9 review each of the six key markets and market drivers for exports via Millennium. Each regional review considers IEA projections for coal imports in each of the regions, supplemented by market analysis validated by range of industry experts. Based on these projections and analyses, each review also provides a projected change in thermal coal imports by region (along with sources and detailed derivation for each regional calculation). The results of each of the calculations are summarized above in Table 6.

As indicated above, the two key markets for US coal exports via Millennium are both large Asian coal importers:

- South Korea (Section 8.4);
- Japan (Section 8.5).

The key drivers of market conditions for US exports via Millennium are the following large coal importers:

- China (Section 8.6)
- India (Section 8.7)
- Other Developing Asia (including Southeast Asia and Taiwan) (Section 8.8) and
- Europe (Section 8.9).

We note that key market drivers also include Europe. US coal exports to Europe are typically via East and Gulf Coast ports. Therefore, Millennium is unlikely to be a competitive source of supply to Europe. But there are market linkages, such that the projected weaker market for thermal coal imports in Europe will be overall unfavorable for Millennium (Section 8.9).

8.3 Selection of Key Markets and Market Drivers for Analysis

The list of key markets and market drivers for exports via Millennium has been identified above. This section further explains how TGG selected these key markets and market drivers to be analyzed in this report.

8.3.1 Five Top Coal-Importing Asian Countries

The Complaint notes that the five top coal-importing countries are in Asia, but focuses on two countries (Japan and South Korea) as markets for coal from Millennium and Lighthouse: South Korea and Japan.[309] The Complaint briefly mentions Taiwan as a potential market.[310]

In addition to these three countries (South Korea, Japan, and Taiwan), the other two Asian countries that have recently been large importers of thermal coal are China and India.[311] As illustrated in Figure 19 to Figure 22, the world's biggest coal exporters, Australia and Indonesia, have also been the biggest exporters to these five large Asian thermal coal markets. Russia, the world's third largest coal exporter, is a smaller exporter to these Asian markets. South Africa is an even smaller exporter to these (and other) markets, and exports notably to India (which is relatively proximate). The US has been a small swing supplier to these (and other) markets, from ports on West Coast, as well as from ports on the East and Gulf Coast (which are relatively proximate to India).

South Korea and Japan are key markets (both existing and potential) for exports via Pacific Northwest ports (notably Westshore in BC and Millennium in Washington). South Korea and Japan are large coal importers, and they are also relatively proximate; other coal importers (including Taiwan, China, and India) are farther south and west in Asia and less proximate to Pacific Northwest ports.[312]

8.3.2 Nexus Between Top Coal-Importing Countries and US PRB Exports

Lighthouse and Cloud Peak Energy have some existing and potential contracts to supply South Korea and Japan. Taiwan is a smaller and less proximate market for exports via Pacific Northwest ports, but it has received some supply from Cloud Peak

Energy. The specific source of coal being exported identified by Lighthouse is Decker Mine in Montana Powder River Basin;[313] Cloud Peak identified Spring Creek Mine (also in Montana Powder River Basin near Decker) as a specific source of coal exports to Asia.[314]

In its comments on the Draft EIS, Cloud Peak Energy indicated that it was the largest single PRB coal exporter in recent years to East Asian countries (including Japan, South Korea, and Taiwan):

> Cloud Peak Energy Inc. ("CPE") is headquartered in Wyoming and is one of the largest U.S. coal producers, with three owned and operated award-winning surface mines located in the Powder River Basin ("PRB") in Wyoming and Montana. […] CPE's approximately 1,500 employees mine low sulfur, sub-bituminous coal and provide logistics supply services. In 2015, CPE shipped approximately 75 million tons from its three mines to customers located throughout the U.S. and around the world. […] CPE has a throughput option agreement for up to 7.7 million tons of capacity per year upon completion of the Millennium Bulk Terminals ("MBT"). CPE has been the largest single exporter in recent years of low sulfur coal from the PRB to East Asian countries that have included, among others, Japan, South Korea, and Taiwan.[315]

8.3.3 Breakdown of Key Markets and Key Market Drivers from Top Asian Coal-Importing Countries

As indicated above, the Complaint focuses on two of the top coal-importing countries (South Korea and Japan) as markets for coal via Millennium. Moreover, Lighthouse has some existing contracts to supply South Korea with PRB coal from the Decker Mine.

Likewise, this report identifies these large proximate Asian coal importers (South Korea and Japan) as key markets for US exports via Millennium.

Of the remaining top-five Asian coal importers, the report has identified China, India and Taiwan as key market drivers for US exports to Millennium. As explained Section 8.2, thermal coal exports via Millennium are unlikely to be a competitive source of supply to China, India or Taiwan: they are farther south and west in Asia and less proximate to Pacific Northwest ports; but there are market linkages to these regions such that weaker markets for coal imports in these regions would be overall unfavorable to Millennium. As such, these countries are identified as market drivers for coal exports via Millennium.

Because of their importance as coal importers, China and India will be reviewed separately as key market drivers. As discussed in the next section, Taiwan will be included in other developing Asia, also a key market driver.

Finally, the report also considers Europe as a key market driver despite the fact that it is not part of Asia. As discussed above, Millennium is also unlikely to be a competitive source of supply to Europe. However, Europe is currently a big thermal coal importer and there are market linkages, such that the projected weaker market for coal imports in Europe will be overall unfavorable for Millennium, as further explained in Section 8.9.

It should also be understood that some of the large coal importers identified in this report as key markets or key market drivers are also coal exporters (e.g. China and India). However, each of the key markets and market drivers is a net large coal importer, but this does not imply that some of them are also sometimes exporters.[316]

8.3.4 Designation of the Other Developing Asia (ODA) Region

In addition to the top five coal-importing Asian markets, Southeast Asian countries (together with a number of Asian countries outside Southeast Asia) are collectively considered as another important and emerging coal-importing market. In this report, these countries have been grouped together into a larger region designated as “other developing Asia” (ODA). The ODA region is less proximate to Millennium than South Korea and Japan and more proximate to more cost-advantaged competitors (such as Indonesia and Australia). Thermal coal exports via Millennium are unlikely to be a competitive source of supply to this region. However, similar to India and China, ODA has market linkages to the rest of Asia and the global coal market. Therefore, the report has identified ODA as a key driver of market conditions for Millennium.

TGG has followed IEA’s geographic organization (as set out in Coal 2017) in our definition of the ODA region. Other developing Asia includes the Southeast Asia region (excluding net coal exporter Indonesia), as well as the “other Asia region” (including Taiwan). See endnote 370 for the detailed list of countries included in ODA.

8.3.5 Importance of Comprehensive Consideration of Key Markets and Key Market Drivers in the Report

This report provides substantial analysis of key markets and market drivers for exports via Millennium. We have reviewed key markets and drivers across Asia, ranging from those markets most proximate to Millennium (South Korea and Japan) to those least proximate (India and Pakistan (included in ODA)). Our analysis is much more comprehensive (both geographically and topically) than the quite limited consideration of Asian markets in the Complaint.

8.4 South Korea (Key Market)

8.4.1 Market Overview

South Korea is a market (both existing and potential) for exports via Pacific Northwest ports (notably Westshore in BC and Millennium in Washington). Lighthouse and Cloud Peak have some existing and potential contracts to supply South Korea with coal from Decker Mine (Lighthouse) and Spring Creek Mine near Decker (Cloud Peak).

In 2017, following the election of President Moon Jae-in, South Korea announced a major policy shift away from coal and nuclear and towards renewables, LNG and increased energy efficiency. WEO 2017 estimated that Korea's coal imports (which included 100 MMTPY of thermal coal) stayed flat in 2016. **With a nearly 50% drop in all coal imports projected by WEO 2017, thermal coal imports decline by 55 MMTPY from the 2016 volumes to 45 MMTPY in 2040. Notably in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in South Korea is projected to <u>shrink</u> by 55 MMTPY.**[317]

8.4.2 Market Analysis

IEA WEO 2017 provides both historical data and long-term projections of South Korean total coal imports (including both thermal and metallurgical coal), emphasizing a recent major policy shift away from coal that will cut imports by half from 2016 to 2040:

> **Korea** announced a policy shift that will reduce the role of nuclear power and coal-fired plants in the generation mix, and support an expanded role for renewable energy technologies and natural gas.[318]
>
> […]
>
> **Korea's** coal imports are estimated to have stayed flat in 2016 at around 115 Mtce. <u>Korea's new government has stated its willingness to reduce the country's reliance on coal, and has outlined a set of measures designed to curb coal use</u>. Among them are the closure of ten old coal plants, a moratorium on new coal plants, a set of environmental criteria for plant dispatch and an increase in coal taxes. As a start, the government ordered a temporary shutdown of eight old coal plants for one month during June 2017. At the same time Korean policy-makers envisage a

> strong push for renewables and natural gas. Against this backdrop, we see Korean coal imports dropping by nearly 50% to less than 60 Mtce in 2040.[319]

IEA Coal 2017 elaborates on the policies that will substantially reduce **thermal** coal imports to South Korea, including in the nearer term (from 2016 to 2022),

> Korean thermal coal imports are […] projected to decline during 2016-22, for a final import need of 77 Mtce in 2022 from 83 Mtce in 2016. It is driven by the new government's policy to reduce local air pollution as well as carbon dioxide (CO_2) emissions. Several measures are planned for this purpose […]. Moreover, Korea introduced a new tax scheme for thermal coal in April 2017 […] this tax scheme is similar to the previous one, and incentivises imports of steam coal with a higher calorific value.[320]
>
> […]
>
> Korea has set strong decarbonisation targets, and the country is struggling with local air pollution. […] low-emissions gas-fired plants are preferred over coal-fired plants […] the government has initiated several measures to reduce coal-fired generation.[321]
>
> […] coal-fired generation will decline 1.8% per year […] by 2022, despite a forecast increase in total electricity generation. Generation from renewable energy sources is expected to nearly quadruple […].[322]

South Korea imported 100 MMTPY of thermal coal in 2016. With the 7% drop projected in IEA Coal 2017 for thermal coal imports, volumes would decline by 7 MMTPY from 2016 to 2022.[323]

IEA WEO 2017 projects that all coal imports (including both thermal and metallurgical coal) will drop by nearly 50% from 2016 to 2040. If thermal coal imports decline at the same rate as all imports, thermal coal imports would decline by 46 MMTPY from the 2016 volumes to 54 MMTPY in 2040.[324] But the factors resulting in lower coal imports to South Korea are focused on electricity generation and thermal coal, rather than metallurgical coal. The decline in imports may be strongly weighted towards thermal coal, such that thermal coal volumes could decline by 55% (or more).[325] Hence, thermal coal imports are estimated to decline by 55 MMTPY from the 2016 volumes to only 45 MMTPY in 2040.

Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in South Korea is projected to shrink by at least 46 MMTPY and possibly by 55 MMTPY (or more).[326]

TGG notes that extensive and recent analysis by the EIA and other industry experts confirms and reinforces the IEA's analysis regarding Korea's major policy shifts away from coal and nuclear and towards renewables, LNG and energy efficiency.[327]

8.5 Japan (Key Market)

8.5.1 Market Overview

Japan is a market (both existing and potential) for exports via Pacific Northwest ports (notably Westshore in BC and Millennium in Washington). Lighthouse and Cloud Peak have some existing and potential contracts to supply Japan with coal from Decker Mine (Lighthouse) and Spring Creek Mine near Decker (Cloud Peak).

In July 2018, Japan approved a new Strategic Energy Plan to increase renewables (including solar and wind) to 22-24% of its energy mix by 2030 while decreasing its reliance on fossil fuels. Plans for new coal plants are being scaled back and may be further scaled back.

Japan imported 138 MMTPY of thermal coal in 2016. **With an over 30% drop in coal imports projected in IEA WEO 2017, thermal coal imports would decline by 43 MMTPY from the 2016 amount to 95 MMTPY in 2040. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in Japan is projected to shrink by 43 MMTPY.**[328]

8.5.2 Market Analysis

8.5.2.1 IEA: WEO 2017 and Coal 2017 Projections

IEA WEO 2017 provides both historical data and long-term projections of Japan's total coal imports (including both thermal and metallurgical coal), emphasizing that growth in renewables and energy efficiency, together with restart of some nuclear plants, will cut coal imports by 30% from 2016 to 2040:

> **Japan's** imports are estimated to have stayed flat in 2016 at just under 170 Mtce in 2016. Its imports are projected to drop by 30% over the period to just over 115 Mtce in 2040, reflecting 60% growth in electricity

> generation from renewables by 2040, together with energy efficiency improvements and the restart of some nuclear power plants. The primary uncertainty for this import trend is the speed at which nuclear power plants are allowed to restart.[329]

IEA Coal 2017 elaborates on the factors that will reduce **thermal** coal imports to Japan, including by 8% in the nearer term (from 2016 to 2022), and maintain Japan's preference for high-quality coal supply from Australia (underlining added for emphasis):

> Seaborne thermal coal imports into Japan are expected to decline slightly, from 117 Mtce in 2016 to 108 Mtce in 2022, an average drop of 1.3% per year. As all the coal used in Japan is imported, the decline is in line with the reduction in demand that will result from restarting the nuclear plants and renewables growth, which will lead to reduced coal-fired electricity generation. […] As in the past, it is expected that Australia will remain Japan's primary coal supplier, as its highly efficient coal-fired power plant fleet is better adapted to the high-quality and quality-consistent coal from Australia.[330]

8.5.2.2 Calculation of Shrinkage in Japan's Coal Imports from 2016 to 2040

Japan imported 138 MMTPY of thermal coal in 2016. With the 8% drop projected in IEA Coal 2017 for thermal coal imports, volumes would decline by 9 MMTPY from 2016 to 2022.[331]

IEA WEO 2017 projects that all coal imports (including both thermal and metallurgical coal) will drop by over 30% from 2016 to 2040.[332] If thermal coal imports decline at the same rate as all imports, thermal coal imports would decline by 43 MMTPY from the 2016 volumes to 95 MMTPY in 2040.[333] Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in Japan is projected to shrink by 43 MMTPY.

8.5.2.3 New Generation of Coal Plants

As will be further discussed in Section 8.5.3, the Complaint (¶29) claims that:

> Japan has specifically identified Powder River Basin (PRB) coal from the United States as having the quality characteristics that are desirable for Japan's next generation of high efficiency, low emissions coal-fired power plants.

Japan's recent stated policy direction on coal is:

> to promote conversion to high efficiency and next-generation coal thermal power generation and utilize this energy source while focusing on reducing the

> environmental load in the long term, for example by making efforts to shift to the cleaner use of gas and fadeout inefficient coal use.[334]

For some years, Japan has been planning new high-efficiency coal plants to replace existing less efficient plants. However, plans for new coal plants are being scaled back and may be further scaled back.[335]

According to our calculations above, thermal coal imports to Japan are expected to begin to decrease by somewhat until 2022 and then by nearly a third from 2016 to 2040. Moreover, as shown in Figure 29, existing PRB exports to Japan are minimal. Also, IEA Coal 2017 (p. 134) has concluded that "As in the past, it is expected that Australia will remain Japan's primary coal supplier, as its highly efficient coal-fired power plant fleet is better adapted to the high-quality and quality-consistent coal from Australia." Still, there could be some opportunities for exports to a niche Japanese market for PRB exports via ports in Washington and BC.

In 2018, for instance, Cloud Peak contracted to supply new IGCC plants (Hirono and Nakoso in Fukushima) with up to 1.3 million tons per year from Spring Creek Mine (near Decker Mine) in 2020-2022.[336]

8.5.2.4 New Strategic Energy Plan

Over the longer term, the IEA projections for a significant decline in coal imports have been further validated by the recent release of Japan's Fifth Strategic Energy Plan. In July 2018, Japan approved a new Strategic Energy Plan, which would increase renewables (including solar and wind) to 22-24% of its energy mix by 2030 while decreasing its reliance on fossil fuels.[337]

As discussed in Section 7.5.4, there is typically a lag in most mainstream economic projections. Therefore, the IEA's analysis based on the available projections in 2017 may still provide an overly optimistic economic outlook for coal import demand in Asia. Given the recent Strategic Energy Plan's objective to move to a cleaner energy mix by 2030, the projected shrinkage in thermal coal imports between 2016 and 2040 may be considerably greater than 30%. Hence, the long-term outlook for US coal exports in Japan may continue to worsen.

8.5.3 Lighthouse Complaint Claim Regarding Japan's New Coal Power Plants

As indicated in Section 8.5.2.3, the Complaint in federal litigation claims the following in ¶¶ 28-29:

> 28. Japan is installing new, clean coal plant technologies to meet environmental targets.[338] […]

> 29. Japan has specifically identified Powder River Basin (PRB) coal from the United States as having the quality characteristics that are desirable for Japan's next generation of high efficiency, low emissions coal-fired power plants.[339]

In support of these claims, the Complaint cites documents from METI (Ministry of Economy, Trade and Industry) and MHPS (Mitsubishi Hitachi Power Systems). MHPS is a joint venture company between (MHI) Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. integrating their operations in thermal power generation systems and other related businesses.[340]

In its latest medium-term business plan, MHI recognizes that a global energy transition is underway owing to measures to address climate change and other shifts (notably the increasing availability and competitiveness of renewables). For electricity generation, MHI acknowledges that the use of coal for electricity generation will decline and renewables will increase.[341] MHI is restructuring its thermal power system business to prepare for declining orders, especially for coal-fired generation:

> Promote structural shift […] to be ready for scale-down of coal-fired thermal business from 2021[342]

With renewable energy gaining traction and environmental regulations growing stronger worldwide, Mitsubishi Heavy expects to exhaust orders for equipment such as steam or gas turbines by 2020.[343]

In light of all of the above (coupled with (a) the IEA's projection for significant shrinkage in long-term coal imports and (b) the recent Strategic Energy Plan's objective to move to a cleaner energy mix by 2030), the long-term outlook for US coal exports from the PRB in Japan is poor. As noted above, there may be some limited niche markets for US PRB exports.[344] However, as indicated above, IEA Coal 2017 (p. 134) expects that as in the past "Australia will remain Japan's primary coal supplier, as its highly efficient coal-fired power plant fleet is better adapted to the high-quality and quality-consistent coal from Australia."

8.6 China (Key Driver)

8.6.1 Market Overview

As explained in Section 8.3.3, thermal coal exports via Millennium are unlikely to be a competitive source of significant supply to the large coal importing markets of China, India, other developing Asia and Europe. These regions are less proximate to Pacific Northwest ports. Nonetheless, there are market linkages, such that a weaker market for coal imports in less proximate parts of Asia and in Europe would be overall unfavorable for Millennium. As such, these countries are identified as market drivers for coal exports via Millennium.

Because of its position as the world's largest coal importer, producer and consumer, China exercises a strong influence on Asian and global coal markets. Its recent restructuring process has affected global coal prices. Therefore, China is a particularly significant market driver for exports via Millennium.

WEO 2017 projects that coal imports to China will decrease by 64% by 2040, but China will remain a net importer of coal. Evolving market conditions in China (and more importantly their effect on the global coal market) are (a) overall negative for Millennium shorter-term; and (b) range from significantly to very negative for Millennium longer-term.

China, the world's largest coal producer and consumer, was also the largest coal importer in 2016. China's dramatic economic growth starting in the mid-1990s was fueled first by domestic coal production and then supplemented by large volumes of imports. As discussed above, China's growth has also been the driving force in the Asian coal boom.

One of the four large-scale shifts in the global energy system identified by WEO 2017 is a massive shift to a cleaner energy mix for China with a rapid deployment of solar PV. Environmental concerns and falling technology costs have strengthened policy support for renewables, which have overtaken coal in net new capacity additions from 2010-2016. China is now a global leader in renewable energy. By 2040, it is expected to become the largest market for solar, wind and hydropower with renewables comprising 57% of total installed capacity (and wind and solar PV making up over a third of total capacity). At the same time, coal demand, now in modest decline, is projected to continue this decline until 2040, when it will account for a significantly smaller share of China's total energy mix. Capping and then reducing coal usage are a means of addressing air pollution and a key priority in China's energy policy.

As discussed in Section 7.6.1, China's coal restructuring process has been underway. Since 2016, restructuring has resulted in a short-term increase in coal imports to China and has driven a recent increase in global coal prices. The impact of China's coal restructuring on Chinese coal imports and prices will be further discussed in Section 8.6.2. According to IEA Coal 2017, these factors are transitory and exports to China are projected to again decline, reversing the recent increases. Moreover, as a result of free trade agreements, both Indonesia and Australia now have an advantage when competing with Chinese production and that of other exporters (notably the US).

Therefore, the longer-term coal import projections and evolving market conditions in China are highly unfavorable for Millennium.

China imported 196 MMTPY of thermal coal in 2016. With the 64% drop in coal imports projected in IEA WEO 2017, thermal coal imports would decline by 126 MMTPY from the 2016 volumes to 70 MMTPY in 2040. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in China is projected to shrink by 126 MMTPY. The projected decline in exports to China (126 MMTPY) is almost three times the full throughput capacity of Millennium (44 MMTPY).[345]

8.6.2 Market Analysis

8.6.2.1 IEA: WEO 2017 and Coal 2017 Projections

IEA WEO 2017 provides both historical data and long-term projections of China total coal imports (including both thermal and metallurgical coal), emphasizing that imports will decline.

IEA WEO 2017 projects that Chinese coal imports will decrease by 64% by 2040:

> Over the Outlook period, coal imports […] decline in China, which in 2016 was the biggest coal importer in the world. Imports continue to play an important balancing role during China's coal industry restructuring process, but this process is assumed to be largely accomplished by the mid-2020 [sic], and China's need for coal imports therefore declines. By 2040, Chinese coal imports have dropped to 70 Mtce, down from nearly 200 Mtce in 2016 […].[346]

IEA Coal 2017 elaborates on the factors relating to China's coal restructuring process, which have resulted in a short-term increase in coal exports to China and higher coal prices. These factors are transitory, and exports into China are projected to again decline, reversing the recent increases. Moreover, as a result of free trade agreements, both Indonesia and Australia now have an advantage when competing with Chinese production and that of other exporters (notably the US):

> After two consecutive years of decline, Chinese coal imports increased […] in 2016 […]. China overtook India to once again become the largest coal importer in the world. Steam coal imports to China totalled 196 Mt in 2016, about 26% (+40 Mt) more than in the previous year. […] In 2016, 74% of imported coal in China was steam coal.
>
> The major reasons for increased coal imports to China in 2016 were the capacity reductions (driven by safety checks) that reduced supply in the domestic market, and the miners' working-day regulation […] that delayed new capacity approvals and cut production. […]
>
> a reduction in import taxes also spurred higher imports. […] Under the free trade agreement between the ASEAN countries and China, no import taxes were imposed on Indonesian coal, which helped promote exports to China. Furthermore, the free trade agreement between Australia and China, signed in June 2015, […] steam coal [..] taxes declined to 4% in 2015, 2% in 2016, and zero in 2017. As a result, <u>both Indonesia and Australia have an advantage when competing with Chinese production and that of other exporters</u>.[347]
>
> […]
>
> Chinese thermal coal imports are forecast to decrease from 137 Mtce in 2016 to 106 Mtce in 2022 […]. During 2017, however, the rising coal import trend of 2016 continues, and from 2018 it is expected to gradually decline. Imports in […] 2022 will have returned to the 2015 level. The main reasons for increased thermal coal imports in 2017 are the restricted supply in the domestic market, the associated higher domestic price compared with that of the overseas market, and slight recovery of the Chinese economy.[348]

8.6.2.2 Calculation of Shrinkage in China's Coal Imports from 2016 to 2040

China imported 196 MMTPY of thermal coal in 2016. With the 64% drop projected in IEA WEO 2017, thermal coal imports would decline by 126 MMTPY from the 2016 volumes to 70 MMTPY in 2040.[349] Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in China is projected to <u>shrink</u> by 126 MMTPY. The projected decline in exports to China (126 MMTPY) is almost three times the full throughput capacity of Millennium (44 MMTPY).

8.6.2.3 Coal Use in China Declines with Major Shift to Renewables

As indicated above, one of the four large-scale shifts in the global energy system identified by WEO 2017 is a massive shift to a cleaner energy mix for China with a rapid deployment of solar PV. Environmental concerns and falling technology costs have strengthened policy support for renewables, which have overtaken coal in net new capacity additions from 2010-2016.

> The growth in the power sector over recent decades […] was built largely on a huge expansion of coal power generation capacity, which increased from 235 GW in 2000 to 945 GW in 2016 (close to half of the world's fleet of coal-fired power plants). However, renewables have begun to take centre stage: they have outpaced the capacity expansion of coal in China in each of the past four years due to strengthened policy support linked to increasing environmental concerns and falling technology costs. From 2012 to 2016, an average of 21.8 GW of wind power was added per year, 20.7 GW of hydropower (including pumped hydro) and 17.7 GW of solar PV. […]
>
> In late 2016 and early 2017, China released the 13th Five-Year Plan for Electricity and Energy, which included a number of targets for the power sector for 2020. Building on progress in recent years, the 13th Five-Year Plan looks to limit the use of coal in power generation and to increase the use of natural gas, nuclear and renewables.[350]

China is now a global leader in renewable energy and the shift to renewables is expected to accelerate between now and 2040.

> China has recently emerged as a global leader in renewable energy and this continues through to 2040 in the New Policies Scenario. […] Over the period to 2040, China is the largest market in the world for solar PV, wind power and hydropower, and the second-largest market for bioenergy-based power plants and other renewable energy technologies collectively. By 2040, renewables make up 57% of total installed capacity, with wind and solar PV together accounting for well over one-third of total capacity.[351]

As the costs for renewable power (and particularly utility-scale solar PV) continue to fall, average solar PV will become cost-competitive with new and existing gas-fired plants by 2020 and cheaper than new coal and wind plants by 2030. By 2040, solar PV is projected to become the cheapest electrical generation in China out-competing operating costs from existing coal plants.[352]

Coal demand, now in modest decline, is projected to continue this decline until 2040, when it will account for a significantly smaller share of China's total energy mix. By 2040, coal is expected to make up about 40% of electrical generation, a significant decrease from the 67% share in 2016.[353] Capping and then reducing coal usage are a means of addressing air pollution and a key priority in China's energy policy.

> The strong rise in the use of low-carbon fuels and natural gas, and the slowdown in total energy demand growth mean that coal accounts for a smaller share of China's future energy mix. [..] Capping and then reducing the use of coal can make an important contribution to tackling air pollution problems, and is an important priority for China in terms of energy policy.[354]

8.6.2.4 Recent Increases in Coal Exports and Prices Are Transitory and Not Reflective of Long-Term Economic Fundamentals

As discussed in Section 7.6.1, since 2016, China's coal restructuring process has resulted in a short-term increase in coal imports to China and has driven a recent increase in global coal prices. According to IEA Coal 2017, these factors are transitory and exports to China are projected to again decline, reversing the recent increases.

IEA WEO 2017 also cautions that:

- recent increases in coal exports and prices are due to transitory factors relating to China's coal restructuring process, and
- current prices levels should be not misinterpreted as a true signal of need for long-term expansions in coal supply (and especially new mining projects requiring large capital expenditures).

According to IEA WEO 2017:

> Chinese coal imports have been volatile since peaking in 2013 […], and they unexpectedly increased by 30% in 2016 as measures to curb capacity led to periods of temporary shortage and price spikes, requiring imports to fill the gap. […][355]
>
> Coal prices have been moving upwards since early 2016, raising the profitability of the coal industry. […] With global demand estimated to have declined over the course of 2016, what bumped prices up on the international market was an (unexpected) increase in Chinese imports following the introduction of measures to control domestic production in

> early 2016. Current price levels should thus not be misinterpreted as a true signal of scarcity. Many new mining projects may now look attractive again, but our projections suggest that Chinese imports will decline again after a period of volatility over the next few years […]. Many mines that have been idled in Indonesia and elsewhere could make a gradual comeback without much capital expenditure.[356]

The IEA along with other industry observers agree that the recent price increases are short-term and the result of the Chinese restructuring process rather than long-term economic fundamentals. The cautions in IEA WEO 2017 are of great relevance for the Millennium Project. Millennium is low-value and high-risk, because it would require large capital expenditures to provide potential swing supply to Asian markets. Therefore, the longer-term coal import projections and evolving market conditions in China are highly unfavorable for Millennium.

8.6.2.5 Boom and Bust in Coal Exports to China

As explained in Section 7.6.1, boom and bust cycles are common in commodity markets and especially mining. A boom is characterized by a period of rising demand and high prices, leading to capacity expansion by suppliers (e.g. new mines, ports, etc.) premised on continued growth in demand and high prices. Boom turns to bust, as oversupply leads to lower prices and market downturns, which can be prolonged. As described in IEA WEO 2017, boom and bust in the Chinese coal industry has contributed to a boom and bust in coal exports and the global coal industry:

- Chinese coal demand boomed from 2006 to 2012;
- China switched from being a net exporter of coal to a net importer in 2009 and soon became the world's largest importer;
- China made huge investments to increase domestic coal supply;
- Chinese coal demand peaked in 2013;
- by 2015, China had excess production capacity greater than the total capacity of the US coal industry;
- coal prices dropped to the point that 80% of the coal firms in China were operating at a loss;
- the Chinese government introduced measures to limit Chinese coal production; and
- coal prices rapidly increased in 2016, raising the profitability of the coal industry in China and globally; and
- coal imports to China increased in 2016 after dropping in 2014 and 2015.[357]

Given boom and bust cycles in the commodity markets, as well as China's coal market intervention, it would be imprudent to infer that current high prices imply long-term potential for exports via Millennium.

8.6.2.6 Coal Exports to China are Uncertain and China could be a Competing Exporter

IEA WEO 2017 also cautions that projections of coal exports to China are highly uncertain, since they are a relatively small item in China's coal supply balance and very sensitive to fluctuations in the domestic supply market.[358] China switched from being a net exporter of coal to a net importer in 2009 and soon became the world's largest importer.[359]

IEA WEO 2017 projects that exports to China will drop by 64% from 2016 to 2040, but China will remain a net importer of coal. **But IEA WEO 2017 explains that China could again become a coal exporter, especially to nearby markets including Japan and South Korea. China becoming an exporter would have a huge impact on international coal markets, keeping prices low for much longer than would otherwise be the case.**

The 64% drop in coal exports to China projected in IEA WEO 2017 is highly unfavorable for exports via Millennium. It would be even more unfavorable for Millennium if exports to China drop to zero. And it would be yet more unfavorable if China becomes a competing exporter to nearby markets (notably Japan and South Korea), which are the key potential markets for exports via Millennium.

As explained in IEA WEO 2017, Chinese government policy and actions are key factors affecting the evolution of the Chinese coal market. Exports via Millennium are unlikely to be economically viable if China moves to phase out coal imports and especially if China moves to become a competing coal exporter.

8.7 India (Key Driver)

8.7.1 Market Overview

US coal exports to India are typically via East and Gulf Coast ports; thermal coal exports via Millennium are unlikely to be a competitive source of supply to the Indian market.[360] Nonetheless, there are market linkages, such that favorable conditions for coal exports into India would be overall favorable for exports via Millennium. Likewise, a weaker market for exports into India would be overall unfavorable for Millennium.

Evolving market conditions in India are (a) overall negative for Millennium shorter-term; and (b) range from slightly positive to significantly negative for Millennium longer-term

India is unlikely to provide a large growth market for thermal coal exports that would offset shrinkage in other Asian markets (notably South Korea, Japan, and China). India's coal imports have declined since 2015 and are projected to continue to decline until at least the early-2020s. Any longer-term growth is expected to be small and highly uncertain. Furthermore, it is highly likely that even if this longer-term growth materializes, it would be served by more proximate competitors (such as Indonesia or Australia), and possibly US coal exports via East and Gulf Coast ports.

As in other Asian (and global) destination markets, conditions are evolving rapidly in India, such that thermal coal exports may continue to decline long-term. As concluded by IEA WEO 2017, this would have significant repercussions for coal exporters around the world, which have planned on India being a large and growing market for coal exports.

Indian coal imports declined in 2015 and 2016; IEA projects that thermal coal exports will continue to decline until at least the early-2020s; any growth longer term is projected to be small and is also highly uncertain.

India imported 152 MMTPY of thermal coal in 2016. With the 20% drop projected in IEA Coal 2017, thermal coal imports would decline by about 30 MMTPY from the 2016 volumes to 2022. IEA WEO 2017 projects that imports will then increase. Thermal coal imports in 2025 would be similar to volumes in 2016 (zero net growth), and imports in 2040 would be about 25 MMTPY higher than in 2016. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal import market in India is projected to <u>shrink</u> by 30 MMTPY by 2022 and then increase, so that the market in 2040 is only 25 MMTPY greater than in 2016.[361]

8.7.2 Market Analysis

8.7.2.1 IEA: WEO 2017 and Coal 2017 Projections

IEA WEO 2017 provides both historical data and long-term projections of Indian coal imports, including both thermal (steam) and metallurgical (coking) coal:

> Indian coal imports fell in 2016 for the second consecutive year. Over the next ten years, steam coal imports remain largely flat while imports of coking coal increase markedly […][362]

> imports, currently in decline, are expected to pick up again from the early 2020s and increase through to 2040 […] with […] a 45% increase over 2016 import levels […][363] with three-quarters of the increase in imports coming from coking coal.[364]

IEA Coal 2017 elaborates on the factors projected to reduce thermal coal imports to India through the early 2020s:

> Imports are projected to decline from 111 Mtce in 2016 to 89 Mtce in 2022 […] As India's thermal coal consumption is expected to continue growing strongly, the decline in imports is expected to be made up for by higher domestic thermal coal production. The Indian government strongly supports import reductions and introduced several policy measures to reach this target. […] it set the ambitious goal of increasing production to 1 500 Mt in 2020, an average yearly increase of 22.7%. […] Production is supported by strong investments in three railways connecting mine mouths with power plants […][365]

IEA Coal 2017 also explains that metallurgical coal imports to India are projected to grow rapidly through the early 2020s; the factors projected to reduce thermal coal imports are not expected to reduce metallurgical coal imports:

> During the forecast period, India is expected to become the world's second-largest producer of steel and blast furnace iron (BFI), the growth of which will propel coking coal demand through 2022.
>
> […] despite the government's push to reduce coal imports, and the forecast decline in thermal coal demand through 2022, it is unlikely that India will be able to reduce its met coal imports. Coking coal reserves in India are limited and most of the resources are of poor quality, not suitable for producing the coke needed for blast-furnace ironmaking. Even assuming a strong increase in coking coal production based on the government's policies, additional amounts required will be obtained through overseas imports, which will increase by 7.7% per year, from 44 Mtce in 2016 to 69 Mtce in 2022.[366]

As explained in IEA WEO 2017 and Coal 2017, potential growth in Indian coal imports is strongly weighted towards metallurgical coal, and efforts towards limiting imports are mainly focused on thermal coal. Millennium would handle only thermal coal. Hence, in analysis of India and potential for exports via Millennium, it is important to focus on thermal coal.

8.7.2.2 Calculation of Change in India's Coal Imports from 2016 to 2040

India imported 152 MMTPY of thermal coal in 2016. With the 20% drop projected in IEA Coal 2017, thermal coal imports would decline by about 30 MMTPY from the 2016 volumes to 2022. IEA WEO 2017 projects that imports will then increase. Thermal coal imports in 2025 would be similar to volumes in 2016 (zero net growth), and imports in 2040 would be about 25 MMTPY higher than in 2016. [367]

Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in India is projected to shrink by 30 MMTPY by 2022 and then increase, so that the market in 2040 is only 25 MMTPY greater than in 2016.

8.7.2.3 Growth in Thermal Coal Imports is Uncertain

As further explained in WEO 2017, the projected long-term increase in thermal coal exports to India is highly uncertain and could be reversed by a variety of factors, including:

- increased domestic coal production,
- an even faster-than-expected growth in renewables (notably solar PV), and
- increased use of natural gas (from increased domestic production and imports, including LNG (liquefied natural gas)).

A reversal in the projected trend of rising coal exports to India is possible and would have significant repercussions for coal exporters around the world:

> India is the hope of many coal-exporting companies around the world. However, the fundamentals for coal demand growth there are less strong than just a few years ago, and it cannot be taken for granted that rising demand will lead to increasing imports.
>
> […]
>
> The utilisation of coal-fired power plants has been dropping over the past years, and that has raised doubts over whether India actually still needs new coal plants once those that are under construction are completed. In the New Policies Scenario, coal remains a key pillar of the power system in India. We project the commissioning of 370 GW of new coalfired capacity over the Outlook period (of which 50 GW are currently under construction).

However as further explained in WEO 2017, this project of 370 GW of new coal plants is subject to many uncertainties, including the rate of economic growth and the rate at which the cost of renewables will decline.[368]

WEO 2017 concludes that coal's number one competitor in India is solar PV. As discussed in Section 8.6.2.3 pertaining to China's shift to renewables, solar PV is fast becoming cost-competitive with coal-fired electricity generation. In fact, solar PV could disrupt the future of coal in India, which had been widely expected to be a long-term growth engine for global coal use:

> **Coal's number one competitor in India: the sun**
>
> […] auction prices for large-scale PV installations have dropped rapidly over the past few years. […]
>
> the cost gap between PV and coal-fired electricity is closing fast and, while coal-fired generation is a mature technology that is unlikely to become significantly cheaper, the future is likely to see further reductions in PV costs. Solar PV could therefore disrupt the future of coal in a country that has been widely expected to be a major growth engine for global coal use for decades to come.[369]

8.8 Other Developing Asia (including Southeast Asia and Taiwan) (Key Driver)

8.8.1 Market Overview

As explained in Section 8.3.4, other developing Asia (ODA) is identified as a key market driver in this report. TGG has followed IEA's geographic organization (as set out in IEA Coal 2017) in our definition of the IEA region. Other developing Asia includes the Southeast Asia region (excluding net coal exporter Indonesia), as well as the "other Asia region" (including Taiwan). See endnote 370 for the detailed list of countries included in ODA.

In contrast to other major markets for thermal coal imports (where imports are expected to decline), IEA WEO 2017 and Coal 2017 project that there will be substantial growth in imports to emerging markets in ODA, including the Southeast Asia region and the "Other Asia" region.[370] The WEO 2017 projections for thermal coal imports to these emerging Asian markets are summarized in Section 7.5.1, and specifically Figure 18 and Figure 19.

Other developing Asia (including Southeast Asia and Taiwan) imported 153 MMTPY of thermal coal in 2016. With the 104% growth in these markets projected in IEA WEO 2017, thermal coal imports would increase by 160

MMTPY from the 2016 volumes to 313 MMTPY in 2040. Put another way, thermal coal imports to other developing Asia are projected to double. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in other developing Asia is projected to grow by 160 MMTPY. The projected increase in exports to other developing Asia (160 MMTPY) is more than three times the full throughput capacity of Millennium (44 MMTPY).[371]

But as explained below, the projected growth in coal exports to ODA is not a strong indicator that market conditions will be overall favorable for exports via Millennium.

First the projected growth in exports to ODA (160 MMTPY) will be more than offset by the projected shrinkage (224 MMTPY) in exports to major Asian markets (Japan, Korea, and China).

Second, the markets that are shrinking are more proximate to Millennium, and the markets that are growing are less proximate. As explained in Section 7.5.1, this shift in demand intensifies the structural disadvantages for exports via Millennium. To the extent that growth in exports to ODA results in favorable market conditions for exports, this will mainly benefit competing suppliers (notably Indonesia and Australia), rather than Millennium.

Third, as further elaborated in Section 8.8.2.3, the projected strong growth in coal exports to ODA is highly uncertain. The factors that have resulted in large shifts away from coal elsewhere in Asia are also reducing potential growth in coal exports to ODA.

8.8.2 Market Analysis

8.8.2.1 IEA: WEO 2017 and Coal 2017 Projections

IEA WEO 2017 provides both historical data and long-term projections of ODA's total coal imports (including both thermal and metallurgical coal).

As discussed in Section 7.4.1, according to the IEA, coal exports will decline to the more mature Asian economies (Japan, South Korea, China), but will grow elsewhere in Asia (notably in Southeast Asia and India). Demand in Asia is shifting to be less proximate to Millennium and more proximate to competitors (notably Indonesia and Australia).

WEO 2017 explains that global coal trade has more than tripled over the past 25 years, but has begun to fall and is expected to decline out to 2040. Underlying this shift from rapid growth to decline are stark regional contrasts with imports declining in most markets, but still projected to grow in emerging markets in other developing Asia:

> Over the Outlook period, coal imports decline in advanced economies like the European Union, Japan and Korea. They also decline in China, which in 2016 was the biggest coal importer in the world. Imports continue to play an important balancing role during China's coal industry restructuring process, but this process is assumed to be largely accomplished by the mid-2020, and China's need for coal imports therefore declines. By 2040, Chinese coal imports have dropped to 70 Mtce, down from nearly 200 Mtce in 2016 […].
>
> The declines are offset by increases in other parts of the world, notably South and Southeast Asia. In India, imports, currently in decline, are expected to pick up again from the early 2020s and increase through to 2040 [...] reaching over 235 Mtce in 2040 – a 45% increase over 2016 import levels […]. Similarly, fast growing and price sensitive economies like Viet Nam, Philippines, Malaysia, Thailand and Pakistan increasingly turn to the international coal market to meet their energy needs.[372]

Similarly, IEA Coal 2017 projects that there will be substantial growth in imports to emerging markets in ODA, including the Southeast Asia region and the "Other Asia" region in the 2017-2022 period.[373]

IEA Coal 2017 elaborates on the factors driving the projected growth in coal imports in Southeast Asia and other Asia; the main driver is new coal-fired electricity generation being added in countries including Vietnam, Malaysia, Pakistan, Bangladesh, and Taiwan (Chinese Taipei). Coal imports in Southeast Asia are typically from Indonesia, which benefits from proximity and low transport costs:

> **Developing Asia (including the ASEAN)**
>
> The expected decline of imports in China, India, Japan, Korea and Europe will be partly compensated for by a strong surge in seaborne traded thermal coal imports in other developing Asian countries, where imports are expected to increase by 5.1% per year during the forecast period. In absolute terms, this means a total increase of 48 Mtce by 2022. Other developing Asian countries, including those of the ASEAN, are projected to make up most of the import decline of other world regions.
>
> Increasing seaborne traded thermal coal imports in the ASEAN countries are spurred by rising demand for coal in the power sector. Gross domestic

> product (GDP) growth in the region is expected to be strong, and to satisfy increasing electricity demand approximately 25 GW of additional coal-fired generation will be commissioned in the region by 2022. Malaysia is projected to remain the largest importer of thermal coal among ASEAN countries, with imports expected to grow by 4.7% per year to 34 Mtce in 2022 based on commissioning of new capacities. The largest growth in thermal coal imports, in absolute as well as relative terms, will take place in Viet Nam. Once a coal exporter, Viet Nam, currently a net importer, is projected to increase imports by 20 Mtce by 2022 to meet increasing demand for coal-fired generation. The majority of the ASEAN countries' coal imports are from Indonesia, which benefits from low transport costs thanks to its geographical proximity to neighbouring import countries. As a result, the boilers of new coal-fired power plants in the region are often designed to burn coal of Indonesian quality.
>
> Other large coal importers in the other developing Asia region include Chinese Taipei, which is the largest: it imported 52 Mtce in 2016 and is expected to increase its imports to 59 Mtce by 2022, based on new plants under construction. Pakistan and Bangladesh will also gain in importance in the global coal market, as imports into Pakistan are projected to increase strongly (18.8%), as are those of Bangladesh during the forecast period, but the greatest import growth lies beyond 2022 […].[374]

However the IEA also emphasizes that the projected strong growth in Southeast Asia coal imports is highly uncertain as will be discussed in Section 8.8.2.3.

8.8.2.2 Calculation of Change in Other Developing Asia's Coal Imports from 2016 to 2040

Other developing Asia (including Southeast Asia and Taiwan) imported 153 MMTPY of thermal coal in 2016.[375] With the 104% growth in these markets projected in IEA WEO 2017, thermal coal imports would increase by 160 MMTPY from the 2016 volumes to 313 MMTPY in 2040.[376] Put another way, thermal coal imports to other developing Asia are projected to double. Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in other developing Asia is projected to grow by 160 MMTPY. The projected increase in exports to other developing Asia (160 MMTPY) is more than three times the full throughput capacity of Millennium (44 MMTPY).

8.8.2.3 Growth in Thermal Coal Imports is Uncertain

As explained by the IEA in Coal 2017, WEO 2017 and Southeast Energy Outlook, the projected strong growth in coal exports to ODA is highly uncertain. The factors that have resulted in large shifts away from coal elsewhere in Asia are also reducing potential growth in coal exports to ODA.

8.8.2.3.1 IEA Coal 2017

IEA Coal 2017 projects that thermal coal imports in ODA will increase from 138 Mtce in 2016 to 186 Mtce in 2022, a growth of about 35%.[377] IEA Coal 2017 provides projections for the nearer term (6 years from 2016 to 2022), rather than the long-term period (24 years from 2016 to 2040) considered in IEA World Energy Outlook. But even over the nearer term horizon considered in IEA Coal 2017, there is substantial uncertainty, and projections can change substantially as each new version of the report is issued annually. Notably, the report issued by IEA in 2016 (one year prior) projected substantially higher growth in imports.[378]

8.8.2.3.2 WEO 2017

WEO 2017 emphasizes that the projected strong growth in Southeast Asia coal demand and imports is highly uncertain. Coal's cost-competitiveness is challenged by the falling cost of renewables, as well as by low-cost LNG. And there is considerable and growing public opposition to coal projects:

> **Southeast Asia is often accepted as an undisputed growth engine for coal demand, but public opposition against coal projects – mostly on environmental grounds such as concerns about local air pollution – is growing. Coal's main advantage in Asia, its cost-competitiveness, is challenged by the falling cost of renewables and, to an extent, by low-cost LNG, so strong growth cannot be taken for granted here either**.[379]
>
> […]
>
> **Southeast Asia, together with India and other developing economies in Asia, is the primary growth centre of coal demand in the world.**[380] **The region's coal consumption grows two-and-a-half times to around 385 Mtce in 2040. Coal demand growth in Southeast Asia is clearly a power generation story: power plants account for three-quarters of the additional coal use in the coming 25 years.** […] **However, some major planned coal projects face considerable public opposition, including the Krabi plant in Thailand, the Inn Din plant in Myanmar and the Atimonan plant in Philippines, which has delayed development of some new capacity**.[381]

8.8.2.3.3 IEA Southeast Energy Outlook

In tandem with WEO 2017, Southeast Asia Energy Outlook provides in-depth analysis of this region.[382] Southeast Asia Outlook elaborates that power generation capacity has grown rapidly in this region; coal-fired capacity (about 40% of recent additions) has tripled since 2000. But deployment of new coal plants is now slowing, symptomatic of intensifying challenges including environmental concerns and financing:

> Installed power generation capacity in Southeast Asia has more than doubled since 2000, to around 240 gigawatts (GW) in 2016. Net capacity additions over the period were primarily coal- and gas-fired power plants, each accounting for around 40% of the increase. There are some signs that <u>the rapid rise in coal-fired capacity, which more than tripled since 2000, is running out of steam: final investment decisions taken on new coal plants in Southeast Asia (except Indonesia) fell in 2016 for a third year in a row</u> […][383] <u>the recent slowdown is symptomatic of the challenges facing the large-scale deployment of new coal-fired power plants, including the need to address environmental concerns and to secure financing</u>.[384]
>
> […]
>
> <u>challenges remain to expand coal-fired capacity, not least public opposition in some countries. Additional challenges involve financing the high upfront costs (when many international development banks are limiting lending to coal projects</u>) […].[385]

Southeast Asia Energy Outlook also demonstrates that a large increase in coal use and imports (as projected in the New Policies Scenario) is not inevitable.[386] If the region instead makes different policy choices (as described in the Sustainable Development Scenario), coal use would decline by 30% in the period to 2040 and would be 70% lower than in the New Policies Scenario. Instead of deploying new coal plants, investments would be shifted to add renewables and increase energy efficiency. As a result, coal use (and imports) would peak around 2025 and then go into a steep long-term decline.

8.8.2.4 Growth in Imports Weighted Towards Metallurgical Coal

Southeast Asia Energy Outlook also identifies that the large projected increase in coal use (and thus imports) includes a large component of steel production (and thus metallurgical coal).[387] To date, the steel industry in Southeast Asia has largely employed electric arc furnaces using recycled steel (which do not require metallurgical coal). But countries such as Vietnam plan to build blast furnaces, (which do require metallurgical coal). Increased use of blast furnaces accounts for one-third of the overall increase in coal use, which more than doubles to 2040. Hence, a sizeable portion of the projected growth in total imports is metallurgical coal, rather than thermal coal.

8.8.2.5 Uncertainty of Growth in the Context of Global Energy Shifts

Over the last few years, major shifts have transformed global energy markets, and the Asian coal boom has largely ended. As projected in IEA WEO 2017 (New Policies Scenario), coal imports will decline across Asia and worldwide in the period to 2040. But these declines are projected to be partially offset by rising imports in ODA and especially Southeast Asia. Put more simply, the Asian coal boom may not yet be completely over in the ODA and especially Southeast Asia, which have access to proximate (and relatively low cost) coal supply from Indonesia.

Hence, some ongoing growth in coal imports is possible and perhaps even likely in ODA. But the amount and duration of this growth is highly uncertain. Most coal markets in Asia and worldwide have shifted from boom to decline, as a result of multiple factors including a major shift to renewables, environmental concerns, and public opposition to coal projects. These factors are also operating (and likely intensifying) in ODA. Development of new coal-fired power plants is being scaled back, and projections of coal use and imports are dropping as energy outlooks are updated to incorporate new developments. Therefore, it is possible and even likely that an analysis based on currently available projections will provide an overly optimistic economic outlook for coal exports (and specifically for exports via Millennium).

Exports via Millennium would include only thermal coal. A sizeable portion of the projected growth in imports to developing and especially Southeast Asia is metallurgical coal, rather than thermal coal. Projections including metallurgical coal will provide and overly optimistic economic outlook for coal exports via Millennium.

8.8.3 Taiwan (Chinese Taipei)

Compared with South Korea and Japan, Taiwan is a smaller and less proximate market for exports via ports in Washington and BC. But it is identified as an existing market by Cloud Peak and a potential market by Lighthouse.

As defined by IEA, Taiwan is included in the other developing Asia region.[388] We have already considered Taiwan in our market analysis of the ODA region in Section 8.8.2. However, as explained below, Taiwan is an advanced economy and mature (and major) market for coal imports. Because of its importance (and uniqueness) among the countries grouped in the ODA region, Taiwan is given separate consideration in this section.

In 2016, Taiwan (Chinese Taipei) was again the world's fifth-largest coal importer.[389] IEA Coal 2017 projects a small increase in thermal coal imports over next few years:

> Chinese Taipei […] imported 52 Mtce in 2016 and is expected to increase its imports to 59 Mtce by 2022, based on new plants under construction.[390]

Taiwan imported 59 MMTPY of thermal coal in 2016. With the 13% increase projected in IEA Coal 2017, thermal coal imports would increase by about 7 MMTPY from the 2016 volumes to 2022. But IEA Coal 2017 cautions that future coal imports are highly uncertain; imports are under pressure in Taiwan, where coal is facing growing social opposition.[391]

More generally, similar to South Korea, Japan, and (increasingly) China, Taiwan is an advanced economy and mature market for coal imports. There is unlikely to be substantial future growth, and imports could decline substantially as older coal plants are phased out and electricity supply shifts towards renewables. As noted in the US EIA Country Profile (Last Updated: December 2016), Taiwan's electricity policy is focusing on replacing older fossil fuel units with more efficient power plants and increasing its installed capacity and generation from renewable sources to diversify fuel sources:

> • […] Coal (45% share), natural gas (31% share), and nuclear power (14% share) make up the bulk of the island's electricity generation portfolio.
>
> • Taiwan's electricity policy is focusing on replacing older fossil fuel units with more efficient power plants and increasing its installed capacity and generation from renewable sources to diversify fuel sources. As a result, Taiwan passed the Renewable Energy Development Act in 2009 and a system for feed-in tariffs for solar and wind power, both which promote installation of electric generation capacity that is fueled by renewable energy sources.
>
> • Taiwan consumed about 68 million short tons of coal in 2015, all of which was imported. Coal consumption steadily increased overall since the

> 1990s and slowed after 2007 as a result of natural gas and renewables substituting some coal supply in the power sector.[392]

8.9 Europe

8.9.1 Nexus to Exports via Millennium

US coal exports to Europe are typically via East and Gulf Coast ports, which are proximate to both US coal production and European destination markets.[393] Thermal coal exports via Millennium are unlikely to be a competitive source of supply to the European market. Nonetheless, there are market linkages, such that a weaker market for exports into Europe would be overall unfavorable for Millennium. As illustrated in Figure 19 to Figure 22, competing coal suppliers can and do export to destination markets in both Europe and Asia. These competing suppliers include Russia and South Africa, but also US coal exports via East and Gulf Coast ports.

With weaker markets for exports into Europe, competing coal supply is pushed towards Asian markets. The US is a swing supplier to global coal markets, and particularly to Asian thermal coal markets where supply from the US is structurally disadvantaged; competing suppliers are more proximate to Asian thermal coal markets and have lower costs to supply these markets. Hence, with weaker markets for exports into Europe, markets for exports into Asia will also be less favorable, especially for exports via Millennium.

8.9.2 Market Overview

IEA WEO 2017 projects that European Union coal imports (including both thermal and metallurgical coal) will decrease by 43% by 2040:

> The European Union (EU) has targets to cut greenhouse-gas emissions by 40% by 2030 (compared to 1990) and to expand renewables to 27% of total final energy consumption.
>
> These have clear negative implications for coal, and various EU countries already have plans in place to close all their coal-fired power plants over the coming decades, including France (by 2023), the United Kingdom (by 2025) and Finland (by 2030). As a result, coal demand in the European Union drops by over 60% in the next 25 years to 135 Mtce in 2040 – a bigger drop than in any other region. Domestic coal production falls even

> faster, reaching less than 50 Mtce in 2040, down from around 175 Mtce in 2016. The combination of the two trends results in a fall in imports from 150 Mtce in 2016 to 85 Mtce by 2040 […].[394]

IEA WEO 2017 projects that coal imports (including both thermal and metallurgical coal) to all of Europe (including EU) will decrease by 33%, from 206 Mtce in 2016 to 138 Mtce by 2040.[395]

Europe imported 192 MMTPY of thermal coal in 2016.[396] **If thermal coal imports decline at the same rate as all imports (the 33% drop projected in IEA WEO 2017), thermal coal imports would decline by 63 MMTPY from the 2016 volumes to 129 MMTPY in 2040.**

The above estimate (thermal coal exports to Europe dropping by 33% and 63 MMTPY) may understate the likely decline in thermal coal exports.[397] **The factors resulting in lower coal exports to Europe are focused on electricity generation and thermal coal, rather than metallurgical coal. Even if all exports drop by 33%, thermal coal may drop by more than 33% (and metallurgical coal by less). Hence, thermal coal imports are estimated to decline by at least 65 MMTPY from the 2016 volumes to no more than 127 MMTPY in 2040.**

Notably, in the period when Millennium could export 44 MMTPY (at full throughput), the thermal coal market in Europe is projected to <u>shrink</u> by at least 63 MMTPY and possibly 65 MMTPY (or more). The projected decline in exports to Europe will push competing coal supply towards Asian markets, resulting in less favorable market conditions for exports via Millennium.

9 Lighthouse Complaint Claims on South Korea and TGG Responses

9.1 Key Findings

Finding 1: Of the two countries (South Korea and Japan) identified in the Complaint as markets for coal via Millennium, South Korea is likely to be the predominant market for potential exports via the Project. (Section 9.2)

Finding 2: Contrary to Lighthouse's Complaint claim that South Korea is a large and growing coal importer, South Korea will be a smaller and shrinking thermal coal importer and a smaller and shrinking potential market for exports via Millennium. (Section 9.3)

Finding 3: Contrary to Lighthouse's Complaint claim, Lighthouse's contracts with South Korean utilities did not obligate deliveries. (Section 9.4.2.1)

Finding 4: In the Complaint, Lighthouse claims that there is not sufficient economic West Coast coal export capacity for Lighthouse to fulfill its contracts with Asian customers. Contrary to this claim, existing port alternatives (including Westshore) enable a large volume of US coal exports. (Section 9.4.2.2)

The above Findings from this section are supportive of two of the seven overarching Key Findings of this report (Key Findings 3 and 4 from Section 1.1):

Key Finding 3: The Project is not needed to supply coal to Asia […]. (Section 9.3)

Key Finding 4: A number of other port alternatives exist that can meet the intermittent and shrinking Asian demand for US thermal coal exports. (Section 9.4.2.2)

9.2 Introduction

This section identifies and responds to Lighthouse Complaint claims on South Korea. Of the two countries (South Korea and Japan) identified in the Complaint as markets for coal via Millennium, South Korea is likely to be the predominant market for potential exports via the Project. Exports to South Korea typically comprise around 80% and often 90% or more of total US thermal coal exports via rail to BC ports/Westshore. Hence, to the extent there has been any market in Asia for US thermal coal (notably

PRB) production exported via Pacific Northwest ports, this market has been largely restricted to South Korea. Therefore, TGG is identifying and responding to the Lighthouse Complaint Claims on South Korea in this section. Lighthouse Complaint regarding Japan's new coal power plants is covered briefly in the Market Analysis for Japan in Section 8.5.3.

In Section 9.3, TGG identifies and responds to the Lighthouse claim that South Korea is a large and growing coal importer. The report demonstrates that South Korea will be a smaller and shrinking thermal coal importer and a smaller and shrinking potential market for exports via Millennium.

In Section 9.4, TGG identifies and responds to the Lighthouse claims regarding Lighthouse contracts with South Korean utilities. In Section 9.4.2.1, TGG demonstrates that contracts with South Korean utilities did not obligate deliveries. And in Section 9.4.2.2, TGG refutes Lighthouse's claim that there is not sufficient economic West Coast coal export capacity for Lighthouse to fulfill its contracts with Asian customers. We discuss how existing port alternatives (including Westshore) enable a large volume of US coal exports.

9.3 Lighthouse Claims: South Korea is a Large and Growing Coal Importer

9.3.1 Complaint

The Complaint (¶¶31-32) claims that South Korea is a large and growing coal importer, seeking additional imports from the US to diversify sources of coal supply:

> In recent years, South Korea has […] scaled back its long-term reliance on nuclear power and increased its coal imports from 131 million short tons in 2010 to 149 million short tons in 2015.[398] […] South Korea is the fourth-largest importer of coal in the world. Coal accounts for 28% of South Korea's installed electricity generating capacity, and 20 new coal-fired power plants are scheduled to enter service by 2022. South Korean energy companies also seek additional U.S. coal imports to diversify the sources of their coal supply.

9.3.2 Response to Lighthouse Claims

9.3.2.1 Thermal and Metallurgical Coal

In analysis of South Korea and potential for exports via Millennium, it is important to focus on thermal coal. Millennium would handle only thermal coal, so the potential market for exports via Millennium is restricted to thermal coal.[399]

The Lighthouse Complaint (¶31) refers to data on total South Korea coal imports (notably 149 MMst in 2015), which include both thermal and metallurgical coal. In recent years, almost 30% of South Korea coal imports are metallurgical coal (used for steel production), and the remainder is thermal coal (mainly used for electricity generation).[400] As discussed in Section 8.4.2, South Korea is now undertaking a major shift away from coal. The resulting reductions in coal use and imports will be mostly (if not all) related to thermal coal. South Korea is projected to substantially reduce thermal coal imports (both near- and long-term), but metallurgical coal imports are projected to increase (at least in the near-term).[401] Hence, metallurgical coal is projected to comprise a large and growing share of total South Korea coal imports. Likewise, thermal coal is projected to comprise a smaller and shrinking share of total South Korea coal imports.

Therefore, South Korea will not be a large and growing coal importer, seeking additional imports from the US to diversify sources of coal supply, as claimed in the Lighthouse Complaint (¶¶31-32). Instead, as demonstrated by the analysis in Section 8.4, South Korea will be a smaller and shrinking thermal coal importer and a smaller and shrinking potential market for exports via Millennium.

9.4 Lighthouse Claims: Lighthouse Contracts with South Korean Utilities

9.4.1 Complaint

The Complaint in federal litigation claims the following in ¶¶45-46 and 49-51 (underlining added for emphasis):

> 45. LHP is party to an amended ten-year contract with a customer in South Korea that was originally executed on May 11, 2012 to deliver two million metric tons per year with the option for the customer to elect to receive an additional one million metric tons per year (Contract #).
>
> 46. LHP is party to another amended contract with a second customer in South Korea, originally executed as a ten-year contract on June 5, 2012, to deliver one million metric tons per year with the option for the customer to purchase an additional one million tons per year (Contract #2).
>
> […]
>
> 49. <u>The lack of sufficient economic west coast coal export capacity has prevented delivery of the coal volumes specified in both Contract #1 and Contract #2. As a result, the contracts had to be amended in December 2015 to make both subject to termination for failure to deliver.</u>

> 50. At present, LHP supplies coal to its Asian customers by shipping coal out of a Canadian port. That port has not contracted sufficient capacity to LHP to fulfill the contracts to which LHP is a party and is approximately 250 miles farther from the mines than the Millennium Bulk Terminal, resulting in increased shipping costs.
>
> 51. LHP needs additional economic coal export capacity to fulfill its contracts and meet market demand.

9.4.2 Response to Lighthouse Claims

9.4.2.1 Contracts with South Korean utilities did not obligate deliveries

The Lighthouse Complaint (¶49) claims that "lack of sufficient economic west coast coal export capacity has prevented delivery of the coal volumes specified in both Contract #1 and Contract #2." But as explained below, both contracts with Southern Korean utilities[402] were (as originally executed) contingent upon completion of Ambre port facility projects (Millennium and/or Port of Morrow). Neither of these projects has been completed, so it does not appear that Ambre (now known as Lighthouse) has been obligated to deliver coal under these contracts.

Ambre Energy North America (AENA, now known as Lighthouse) and its Australian parent company (Ambre Energy, Ltd. (AEL)) made the following statements regarding export contracts with South Korean utilities in a July 30, 2012 "Decker Litigation" filing:

> 27. Ambre Energy North America, Inc. ("AENA") owns AE Infrastructure, LLC ("AE Infrastructure"), which in turn owns a controlling interest in Millennium Bulk Terminals-Longview, LLC ("Millennium"), a joint development with Arch Coal, Inc. ("Arch Coal"). Through other subsidiaries, AE Infrastructure also owns a port development project at Port of Morrow in the state of Oregon […]
>
> 28. Millennium is a bulk commodities port on the Columbia River in Washington, and Port of Morrow is the site of a proposed coal terminal port farther up the Columbia River (collectively, the "Ports").
>
> 29. When fully operational, the Ports will be capable of handling a significant increase over the quantity of coal currently shipped through West Coast ports.
>
> […]
>
> 32. AEL has entered into agreements with two utilities in Korea to sell up to 5 million tons of coal per year over a ten-year period at prices prevailing

> in Asia. […] The obligation to deliver this coal is contingent on the completion of one or more of AE Infrastructure's port facility projects.[403]

9.4.2.2 Port Alternatives (including Westshore) enable a large volume of US coal exports, but export volumes fluctuate based on market conditions

9.4.2.2.1 Overview

The Lighthouse Complaint (¶¶49-51) acknowledges that Lighthouse has been able to supply coal to its Asian customers via a port in Canada (Westshore),[404] but claims that this port alternative:

- is about 250 miles further from the mines than Millennium, resulting in higher shipping costs; and
- has not contracted sufficient capacity for Lighthouse to fulfill its contracts with Asian customers (South Korean utilities).

Moreover, the Lighthouse Complaint claims that the lack of sufficient West Coast coal export capacity resulted in contracts with South Korean utilities being amended in December 2015.

The analysis in Section 7.7.3.3 (Westshore vs. Millennium) demonstrates that overall transport costs via Westshore are likely similar to transport costs via Millennium (Section 9.4.2.2.2). The analysis in Section **Error! Reference source not found.** d emonstrates that existing ports and infrastructure (including Westshore) enable the US to export large volumes of both thermal and metallurgical coal to South Korea. The analysis in Section 7.7.3.3 (Westshore vs. Millennium) demonstrates that overall transport costs via Westshore are likely similar to transport costs via Millennium.

The analysis in Section 9.4.2.2.4 demonstrates that exports and utilization of existing ports and infrastructure have varied substantially in recent years based on fluctuating market conditions.

Based on the publicly available information, TGG concludes that Lighthouse has been able to export thermal coal to South Korea when market conditions have been favorable, and Lighthouse has chosen not to export when market conditions were not favorable. Moreover, as discussed in Section 9.4.2.1, the Lighthouse contracts with South Korean utilities (prior to any amendments agreed to in 2015) did not obligate Lighthouse to deliver coal.

Hence, it is unclear to what extent, if any, Lighthouse exports have actually been constrained by a lack of sufficient economic West Coast coal export capacity. Lighthouse has failed to demonstrate actual and likely impacts, and the publicly available information indicates that any impacts are (at most) small and speculative.

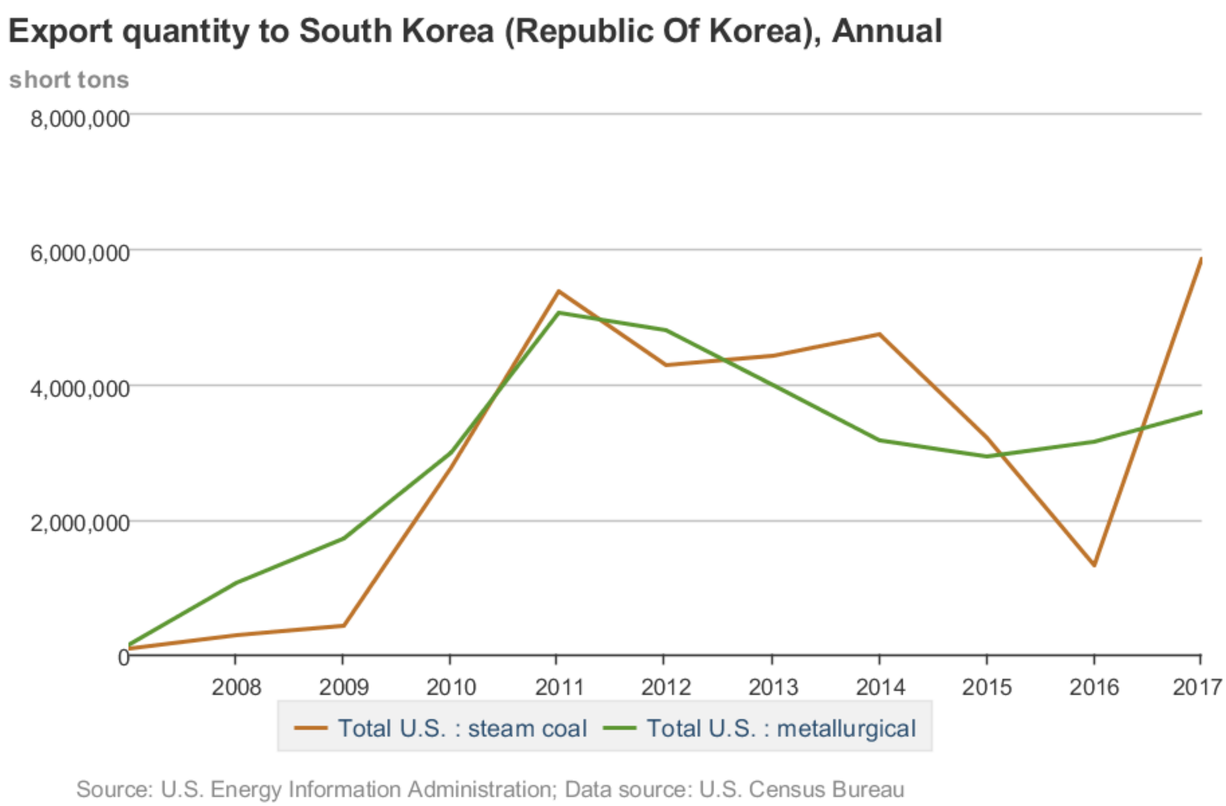
9.4.2.2.2 Westshore Provides a Cost-Effective Port Alternative

As was demonstrated by the analysis in Section 7.7.3.3, overall transport costs via Westshore are likely similar to transport costs via Millennium. Westshore is further from PRB mines (longer rail distance), but handles large Capesize ships and also longer unit trains. Westshore is also an existing permitted facility with demonstrated ability to continue operating under wide variety of fluctuating market conditions.

9.4.2.2.3 Existing Ports and Infrastructure Enable Large Volumes of US Exports

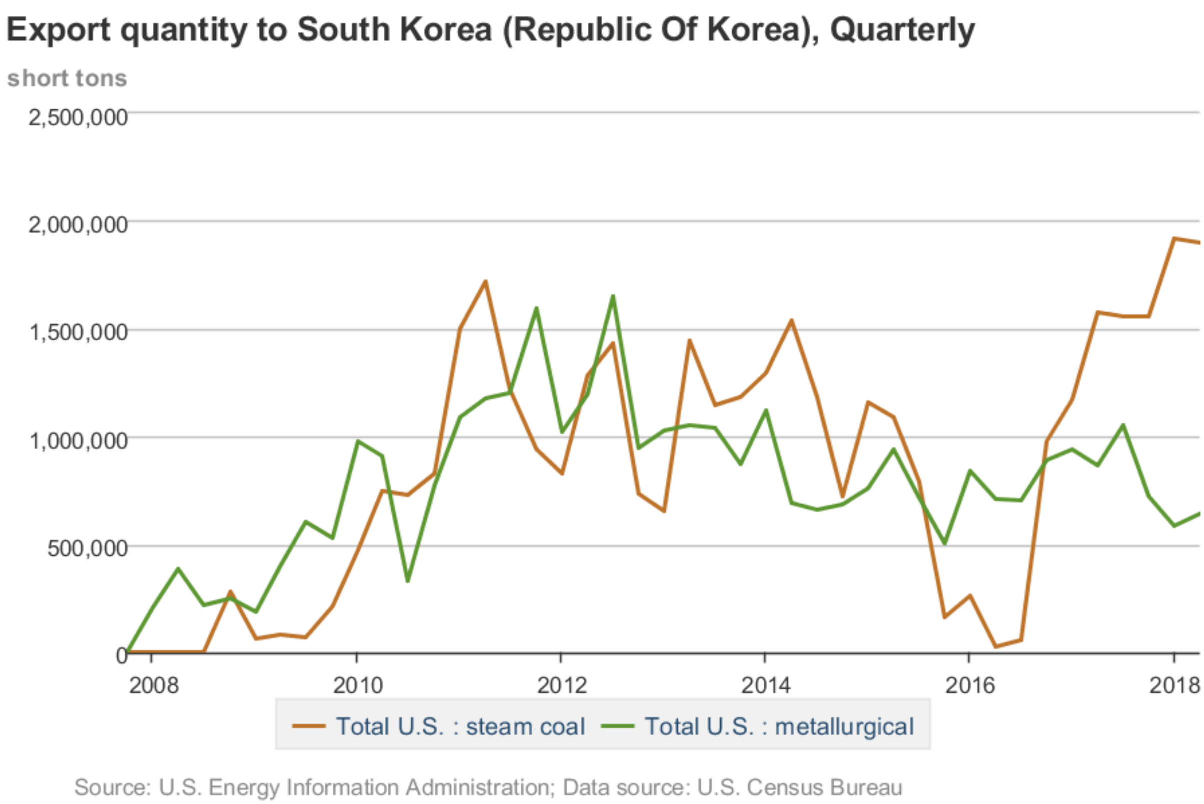
Existing ports and infrastructure (including Westshore) have enabled the US to export large volumes of both thermal and metallurgical coal to South Korea in recent years. Figure 27 provides annual data and Figure 28 provides quarterly data.

Figure 27: US Thermal and Metallurgical Coal Exports to South Korea (Annual 2007-2017)



Source: EIA Coal Data Browser.[405]

Figure 28: US Thermal and Metallurgical Coal Exports to South Korea (Quarterly 2007 Q4-2018 Q2)



Source: EIA Coal Data Browser.[406]

Over the last decade, the US has exported thermal coal to South Korea, with volumes up to about 6 MMst annually (and 2 MMst in some quarters, especially recently). These exports have been mainly via ports on the West Coast (notably Westshore in BC, but also ports in California), which are proximate to Western US coal production (notably Powder River Basin in Montana and Wyoming, as well as Uinta Basin production in Colorado and Utah).[407]

When market conditions have been favorable, US thermal coal exports to South Korea have also included 1 MMst annually (and 0.5 MMst in some quarters) via ports on East and Gulf Coasts (notably Norfolk, Baltimore, and New Orleans). These ports are proximate to coal production in Appalachia and Illinois Basin, but can also be used to export Western US coal production.

In recent years, the US has also exported to South Korea up to 5 MMst of metallurgical coal production via proximate ports on the East Coast (notably Norfolk and Baltimore) and sometimes on the Gulf Coast (notably New Orleans). US metallurgical coal production (located in Appalachia) is not proximate to West Coast ports, and the US does not export metallurgical coal via the West Coast. Western Canadian metallurgical coal production is proximate to the West Coast, and this production is exported to South Korea via proximate ports (Westshore and Ridley in BC).

9.4.2.2.4 Export Volumes and Utilization of Ports and Infrastructure Fluctuate Substantially

As shown in Figure 27 and Figure 28, export volumes fluctuate substantially year-by-year and even more substantially quarter-by-quarter. Thermal coal volumes have been especially variable, ranging from zero to almost 2 MMst per quarter. Hence, thermal coal exports (and utilization of related ports and infrastructure) have sometimes been sizeable and sometimes been at or near zero, notably when exports of US thermal coal were not profitable given prevailing prices in coal export markets.

This variability typically reflects market conditions, rather than infrastructure and logistical constraints. Port capacity remains in place and (if anything) has grown over time as terminals have been added and expanded. This available port capacity is more fully utilized when market conditions are favorable and it is profitable to export. But exports (and especially thermal coal exports) can drop to low volumes or even zero when market conditions are not favorable. Notably, as shown in Figure 28, US thermal coal exports to South Korea (via West Coast ports and more generally) dropped to zero (or close to zero) when the export market was weak in 2015 and 2016 (specifically 2015 Q4 to 2016 Q3).[408]

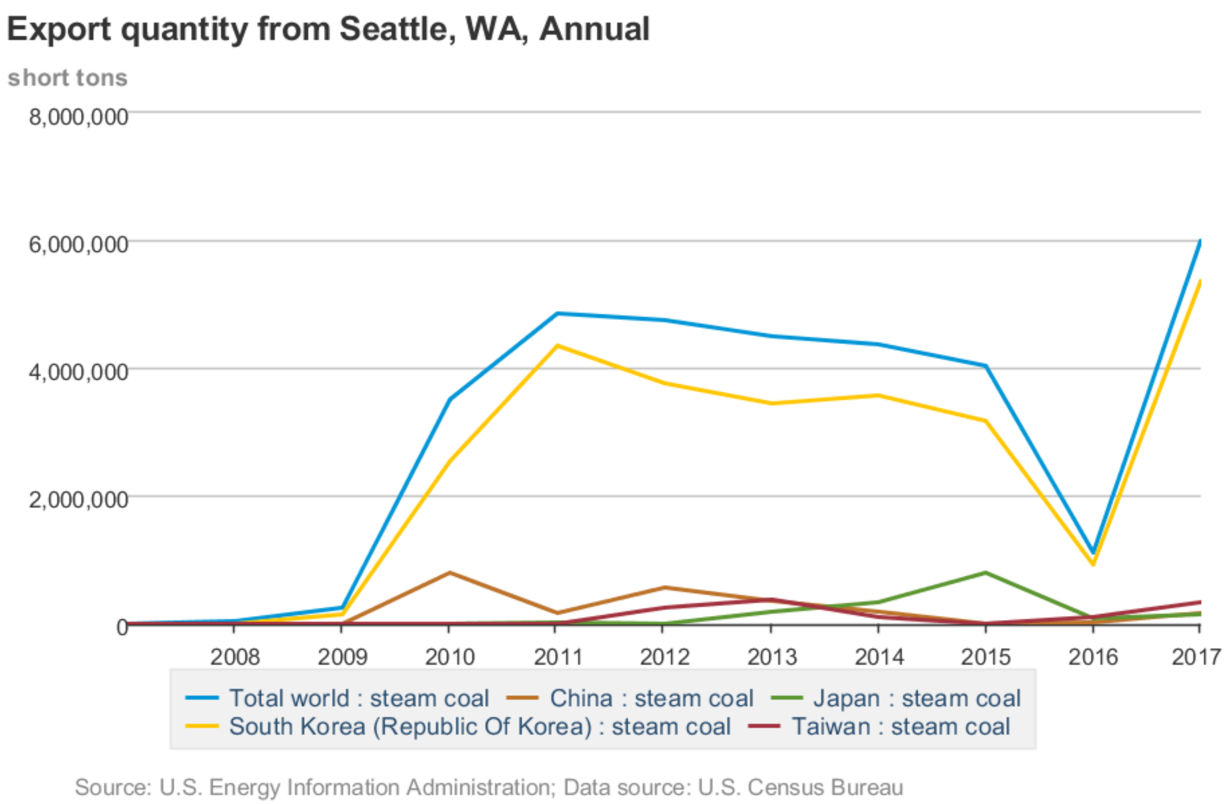
Figure 27 and Figure 28 provide response to the claims in the Lighthouse Complaint (¶49) that it had to amend its contracts with South Korean utilities in December 2015 owing to a lack of sufficient economic West Coast coal export capacity. In fact, US thermal coal exports to South Korea (via West Coast ports and more generally) dropped to zero (or close to zero) from late 2015 to late 2016.

In this context, there was substantial unused West Coast coal export capacity. Lighthouse (and other coal producers, notably Cloud Peak) could have exported more coal (specifically to South Korea), but they chose not to export at a loss. As is typical for coal exports to Asia, the Lighthouse contracts with South Korean utilities specify that any coal delivered would be at prices then prevailing in Asia; these prices were very low in December 2015.[409]

Following four years of continuous declines, coal prices rebounded strongly after mid-2016 in response to actions by the Chinese government to manage coal supply.[410] In late 2016, US coal exports to South Korea resumed, including Lighthouse contracting for and commencing exports via Westshore in October 2016.[411]

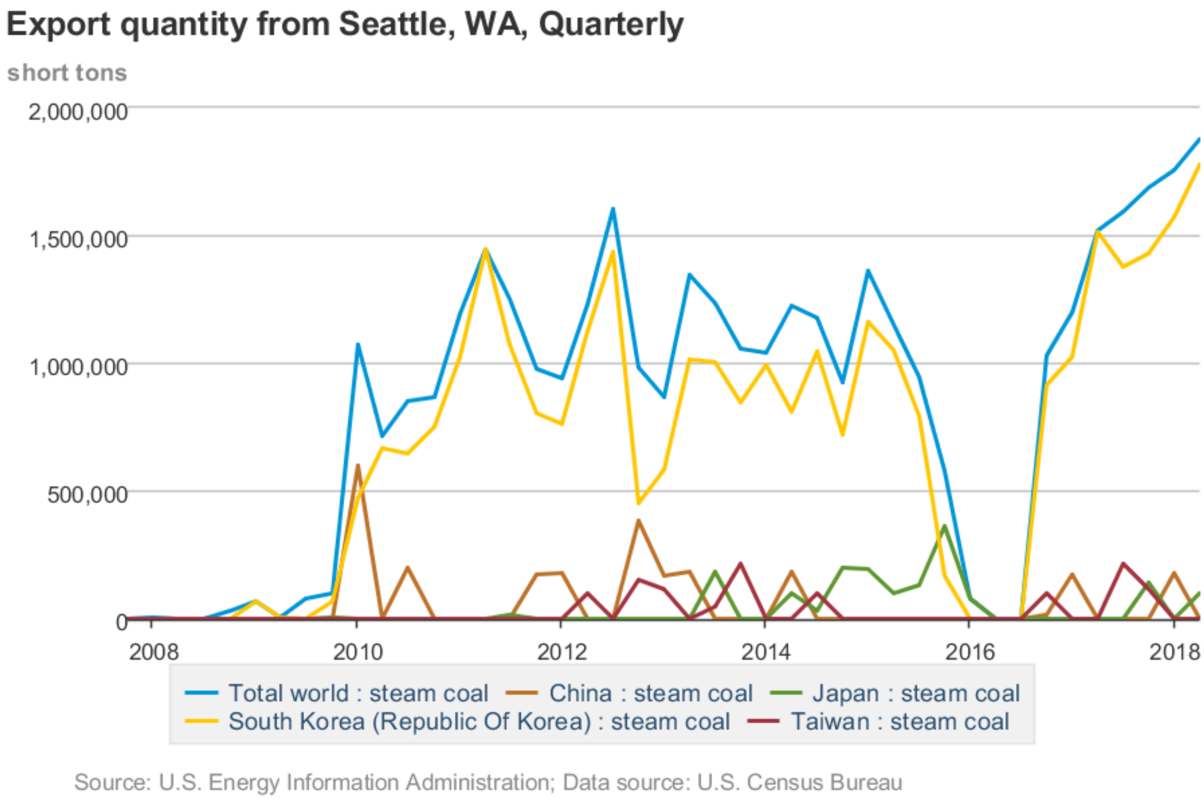
Analysis of EIA data for coal exports via Seattle (rail to Westshore) in recent years confirms that these exports are all thermal coal and virtually all to South Korea.[412] Figure 29 provides annual data and Figure 30 provides quarterly data.

Figure 29: US Thermal Coal Exports via Seattle (Rail to BC Ports/Westshore: Annual 2017-2017)



Source: EIA Coal Data Browser.[413]

Figure 30: US Thermal Coal Exports via Seattle (Rail to BC Ports/Westshore: Quarterly 2017 Q4-2018 Q2)



Source: EIA Coal Data Browser.[414]

Significant US exports of thermal coal via rail to BC ports/Westshore began in 2011, with volumes up to about 6 MMst annually (and over 1.5 MMst in some quarters, especially recently). Exports to South Korea typically comprise around 80% and often 90% or more of total US thermal coal exports via rail to BC ports/Westshore. Volumes to South Korea are sometimes over 5 MMst annually (and over 1.5 MMst in some quarters), especially recently.

Aside from these exports to South Korea, virtually all US thermal coal exported via BC ports/Westshore goes to three other major Asian coal markets, especially to Japan, but also to Taiwan and China. Total volumes to these other 3 markets are 1 MMst (and over 0.25 MMst in some quarters).

Hence, to the extent there has been any market in Asia for US thermal coal (notably Powder River Basin) production exported via Pacific Northwest ports, this market has been largely restricted to South Korea.

And shown in Figure 29 and Figure 30, export volumes fluctuate substantially year-by-year and even more substantially quarter-by-quarter. Notably, as shown in Figure 30, US thermal coal exports via Pacific Northwest ports (to South Korea and overall) dropped to zero (or close to zero) when the export market was weak in 2015 and 2016 (specifically 2015 Q4 to 2016 Q3).

And even at peak volumes, US thermal coal exported via BC ports/Westshore has been only about 12-15% of Millennium capacity (44 MMTPY at Full Build-Out Operations).

The real-world experience to date for US thermal coal exports via Pacific Northwest ports to Asian markets has been

- virtually all (80-90%) tonnage goes to just one market (South Korea);
- virtually all of the remaining tonnage goes mainly to Japan,
- volumes that fluctuate substantially based on market conditions, ranging from zero to more significant levels.

10 Project Has Few Jobs

10.1 Key Findings

Finding 1: The Project creates very few jobs in Washington State and very few jobs in the overall US economy. (Section 10)

Finding 2: Potential job impacts in Washington from the Project are very small, especially in the context of the overall state economy. (Section 10.4).

Finding 3: Even based on Lighthouse's overstated claims, Project construction and operations would result in only a few hundred jobs per year (Sections 10.4.3 and 10.4.4)

Finding 4: Potential mining job impacts outside Washington (in Montana and Wyoming) related to the project are very small **(to non-existent)** in the context of these state economies; and tiny **(to non-existent)** in the context of the US economy. (Section 10.5)

Each of the above Findings from this section is supportive of the overarching Key Finding 7 of this report (from Section 1.1):

Key Finding 7: The Project creates very few jobs in Washington State and very few jobs in the overall US economy. (Section 10)

10.2 Introduction

The Project would result in few jobs in Washington and other states.

The Complaint in federal litigation refers to jobs and other benefits in both:

- Washington (and specifically Cowlitz County), from Project construction and operations (¶72-74); and
- throughout the US (and specifically in MT and WY) relating to coal exports (¶75-77).

As explained in Section 10.3, jobs are an indicator of broader economic benefits. Section 10.4 therefore reviews Lighthouse's claims of job impacts in Washington as outlined in the BERK study and Section 10.5 analyzes job impacts of the Project outside Washington. Section 10.4 shows that potential jobs in Washington from the Project are very small, especially in the context of the overall state economy. Even based on Lighthouse's claims (which are overstated), the Project construction and operations would result in only a few hundred jobs per year. To analyze jobs outside Washington, Section 10.5 evaluates mining jobs and spin-offs related to Millennium in Montana and Wyoming, the states of origin of most (if not all) of the coal to be exported from the Project. TGG demonstrates job impacts outside Washington related to the Project are also very small (to non-existent) in the context of the Montana and Wyoming economies and extremely small (to non-existent) in the context of the entire US economy.

10.3 Job Impacts as an Indicator of Economic Benefits

Jobs, including spin-offs,[415] are a useful (if imperfect) indicator of the broader economic benefits of projects, such as Millennium. Other economic activity is typically at least partially correlated with jobs (especially total jobs including spin-offs). Moreover, jobs are also easier to understand than other metrics as an indicator of the broader economic benefits.

Direct on-site jobs (to build and operate Millennium) most tangibly reflect the economic benefits of the Project and are the easiest to measure. If the Project were not built, the economic benefits of the Project in terms of direct on-site jobs would not be realized.

However, consideration of direct jobs alone may understate the economic contribution of the Project. Consequently, it is also useful to consider spin-off jobs from the Project, along with direct on-site jobs, as an indicator of the broader potential economic benefits of the Project. If the Project were not built, the broader potential economic benefits of the Project would not be realized.

TGG has therefore reviewed Lighthouse's claims of job benefits as outlined in the BERK Study. As discussed in Section 10.4.3, BERK limits its consideration of employment impacts of the Project to jobs within Washington State. To give a fuller consideration of the broader potential economic benefits of the Project (in regard to coal industry transactions with nexus to Millennium), TGG will also evaluate mining jobs and spin-offs outside of Washington, related to Millennium. Our review of jobs outside Washington evaluates mining job impacts in Montana and Wyoming, the states of origin for most (if not all) of coal to be exported from the Project. Mining job impacts outside Washington will be analyzed in Section 10.5.

10.4 Jobs in Washington

10.4.1 Introduction

This section reviews Lighthouse's claims of job impacts in Washington as outlined in the BERK study. TGG's analysis concludes that potential jobs from the Project are very small, especially in the context of the Washington economy. Even based on Lighthouse's claims (which are overstated), the Project construction and operations would result in only a few hundred jobs per year.

As further explained in Section 10.4.3.3, the estimates in the BERK study for operations jobs are based on the maximum throughput assumptions for coal exports via Millennium (i.e. 25 MMTPY during Stage 1b and 44 MMTPY during Stage 2 Full-Build-Out Operations in 2028). However, as concluded in Section 7, the project is unlikely to consistently operate at levels close to these maximum throughput assumptions. This is another reason why BERK's estimate of a few hundred permanent operating jobs is overstated.

The Project is a very large facility, with very small labor requirements for operations. This low labor intensity results from the highly mechanized/automated nature of the facility, the very large scale of operations, and the type of commodity being handled (Section 10.4.2).

In the Complaint, Lighthouse cites an economic impacts study prepared by BERK (on behalf of Millennium Bulk Terminals—Longview, LLC (MBT), a subsidiary of Lighthouse), which estimates how money spent constructing and operating the Project will result in jobs and other benefits in Washington (Section 10.4.3). These estimates are overstated and should not be relied upon in determination of Project impacts (Section 10.4.4).

10.4.2 Project is Large but Jobs are Small

Potential jobs from the Project are very small, especially in the context of the Washington economy. Total employment in Washington is now more than 4.4 million.[416] Without the Project, Washington employment has been growing and is forecasted to continue growing.[417] Even based on Lighthouse's claims (which are overstated), the Project would result in only a few hundred jobs per year. Hence, potential jobs from the Project would be less than 0.01% of total Washington jobs (based on the overstated results from the BERK Study) and possibly considerably less.

As further explained in Section 10.4.3.2, Lighthouse claims that Project construction will result in 1350 temporary direct on-site jobs.[418] Construction would occur over multiple years, so the annual construction employment impact is a fraction of this total. The FEIS assumes a construction duration of 6 years.[419] 1350 jobs over six years are the equivalent of only 225 jobs per year.[420]

As further explained in Section 10.4.3.3, Lighthouse claims that Full Build-Out Operations (44 MMTPY) will result in 135 direct on-site jobs (employees).

In the Complaint (¶75), Lighthouse has also estimated that the Project could result in spin-off jobs off site. Including a wide range of spin-offs throughout the economy and throughout Washington (as well as direct jobs on site), Lighthouse (in the BERK Study and elsewhere) claims that Project construction would result in 2650 total jobs.[421] Over a six-year construction duration, 2650 jobs are the equivalent of only about 440 jobs per year.

Likewise, the BERK Study claims that Project operations would result in a total of 300 jobs per year (including direct and spin-offs). Hence, even with spin-offs, the total jobs estimated by the BERK Study would be less than 0.01% of total Washington jobs.

As further explained in Section 10.4.4, Lighthouse's jobs claims are overstated and cannot be relied upon in determination of Project impacts. Therefore, more realistic estimates of potential jobs from Project construction and operations would be even more negligible than would be concluded based on Lighthouse's estimates. Especially in the context of the overall Washington economy, the Millennium Project would result in very few jobs.

The Project is a very large facility, with very small labor requirements for operations. This low labor intensity results from the highly mechanized/automated nature of the facility, the very large scale of operations, and the type of commodity being handled. This low labor intensity helps to reduce costs to increase the economic viability of handling and transporting a low-value dry bulk commodity (thermal coal).

Compared with a smaller project, the large size of the Millennium Project might be thought to result in proportionally large in-state employment and economic benefits (including a very wide range of spin-offs throughout the supply chain and economy). But in fact, the benefits are very small, despite the large size. Notably, job impacts for Full Build-out/Stage 2 Operations (44 MMTPY) are only marginally larger than for Stage 1b Operations (25 MMTPY).

10.4.3 Lighthouse's Estimates (BERK Study)

10.4.3.1 Introduction

In regard to jobs and other benefits in Washington (and specifically Cowlitz County) from Project construction and operations, the Complaint in federal litigation (¶¶72-74) refers to the economic impacts study prepared by BERK on behalf of Millennium Bulk Terminals—Longview, LLC (MBT), a wholly owned subsidiary of Lighthouse.[422] This study estimates how money spent constructing and operating the Project (paying employees and other expenses) will result in direct impacts and spin-offs. The direct impacts include on-site jobs from building and operating the Project; spin-offs include off-site jobs in Washington.[423]

The BERK Study assumes that the coal handled by the Project would be produced even without the Project; hence, the jobs and business activity associated with mining and transportation of the coal are likely to occur regardless:[424]

> There will be jobs, wages, and fiscal impacts created along the entire supply chain associated with the coal export terminal, from the point of extraction to the ultimate delivery of the material. However, for the purposes of this analysis, the assumption is that the coal that would be handled at the Millennium site would be extracted even without the new export facility. The jobs and business activity associated with the mining and transportation of the coal are likely to occur regardless.

In turn, the BERK Study focuses on impacts relating to on-site construction and operations:[425]

> As a result, the scope of the economic and fiscal benefit analysis is focused on impacts relating to on-site construction and operations, since the key issue that is being explored is what the local and state benefits might be if the material is exported through the proposed Millennium facility.

As noted above, estimates of jobs provided in the BERK Study are generally in terms of job-years (1 job-year = 1 full-time job for 1 year).[426]

It is important to note the Complaint in federal litigation departs from the BERK Study assumption (described above) that the business activity associated with mining and transportation will occur regardless of the Project. Instead, the Complaint asserts that the Project will support jobs outside Washington relating to coal production and export, notably in Montana and Wyoming (¶¶75-77). To give a fuller consideration of the broader potential economic benefits of the Project with nexus to Millennium, TGG will also consider mining jobs and spin-offs outside of Washington, particularly in Montana and Wyoming in Section 10.5.

10.4.3.2 Project Construction

10.4.3.2.1 Direct On-Site Jobs

Based on the BERK Study,[427] Lighthouse claims project construction would result in 1350 temporary direct jobs. This claim is included in the SEPA FEIS (p. 2-2) and cited in the Lighthouse Complaint (¶72).

The BERK Study assumes about $600 million (2010$) in total construction expenditures, but acknowledges that much of this is for equipment from companies outside WA.[428] In-state expenditures giving rise to Washington direct jobs are estimated to be $232 million, resulting in 1350 temporary direct jobs. For direct on-site construction jobs, these claims are equivalent to 5.8 JPM (jobs per $1 million of expenditures) for in-state expenditures and 2.3 JPM for total construction expenditures.

10.4.3.2.2 Off-Site Spin-Off and Total Jobs

Based on the BERK Study, Lighthouse also claims project construction would result in 1300 temporary indirect and induced direct jobs, in addition to 1350 temporary direct jobs.

As noted in Section 10.4.3.2.1, the BERK Study assumes $600 million in total construction expenditures, but acknowledges that much of this is for equipment from outside Washington.[429] In-state expenditures giving rise to Washington jobs are estimated to be $232 million, resulting in 2650 jobs (1350 temporary direct jobs and 1300 temporary indirect and induced jobs). For total construction jobs (direct, indirect and induced), these claims are equivalent to 11.4 JPM (jobs per $1 million expenditures) for in-state expenditures and 4.4 JPM for total construction expenditures.

10.4.3.3 Project Operations

10.4.3.3.1 Direct On-Site Jobs

Based on the estimates provided by MBT (the Applicant in the SEPA EIS), on-site employment with Stage 2 Full Build-Out Operations (135 employees for up to 44 MMTPY) would be only slightly higher than with Stage 1b Increased Operations (112 employees for up to 25 MMTPY).[430] Thus, each million metric ton of annual throughput results in 3.1 jobs with Full Build-Out Operations (44 MTPY), as compared to 4.5 jobs with Increased Operations (25 MMTPY).[431]

Put more simply, that's a lot of coal per employee. With Full Build-Out Operations, throughput per employee would be around 326,000 metric tons per year, or around 163 metric tons per hour.[432]

10.4.3.3.2 Off-Site Spin-Off and Total Jobs

The BERK Study estimates that in addition to direct on-site jobs, there will be spin-off (indirect and induced) jobs off site in Washington:

- Stage 1b (25 MMTPY): In addition to 112 direct on-site jobs, there will be another 118 spin-off jobs, for a total of 230 jobs in WA;
- Stage 2 (44 MMTPY): In addition to 135 direct on-site jobs, there will be another 165 spin-off jobs, for a total of 300 jobs in WA.

BERK assumes that for each on-site job, there will be another 1.05 spin-off jobs (Stage 1b) or 1.22 spin-off jobs (Stage 2). Total jobs, therefore, are claimed to be more than twice the number of on-site jobs.

On this basis, each metric ton of annual throughput results in:

- Stage 1b (25 MTPY): 9.2 jobs (including spin-offs);
- Stage 2 (44 MMTPY): 6.8 jobs (including spin-offs).

As explained in Section 10.4.1, the estimates in the BERK study for operations jobs are based on the **maximum throughput assumptions for coal exports via Millennium** (i.e. 25 MMTPY during Stage 1b and 44 MMTPY during Stage 2 Full-Build-Out Operations in 2028).[433] As discussed in Section 7, the US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. And there are a number of other port alternatives that can meet the intermittent and shrinking Asian demand for US thermal coal exports. **As such, the Project is unlikely to consistently operate at levels close to these maximum throughput assumptions.** This is another key reason why BERK's estimate of a few hundred permanent operating jobs is overstated.

10.4.4 Lighthouse's Estimates (BERK Study) Overstated and Should Not be Relied Upon

10.4.4.1 Introduction

Lighthouse's estimates of economic benefits (based on the BERK Study) are overstated and should not be relied in determination of Project impacts.

In addition, to the overstatement of operations jobs due to BERK's assumption of full throughput as discussed in the previous section, there are four additional reasons why BERK's estimates are overstated and unreliable. First, as explained in the SEPA DEIS and NEPA DEIS, data provided by the BERK Study were not independently verified by the EIS preparers and technical details on the input-output model (I-O model) used by BERK were not provided by the Applicant (i.e. MBT, a subsidiary of Lighthouse):[434]

> **Local Economy**
>
> […]
>
> The projections of potential direct, indirect, and induced economic and fiscal benefits […] are derived from the study titled Economic and Fiscal Impacts of Millennium Bulk Terminals Longview prepared by BERK (2012) on behalf of the Applicant. The data provided by this study have not been independently verified by the lead agency. This study used an input-output model to estimate the economic and fiscal impacts of the proposed project in terms of jobs, wages, and economic output; specific technical details on the input-output model were not provided by the Applicant.[435]

Second, direct on-site construction jobs have been overestimated in the BERK Study. This is the result of its reliance on input-output modelling, which can substantially overestimate jobs, especially for direct on-site construction jobs (Section 10.4.4.2).

Third, as explained in the DEIS and NEPA DEIS, the BERK Study assumes wages for Project operations which are much higher than the likely actual wages at the terminal; hence, this assumption also contributes to BERK's overstatement of the estimated economic impacts. (Section 10.4.4.3).

Fourth, another limitation of I-O modelling is that it tends to overstate actual net job impacts, especially in a context of tighter labor market conditions, as is increasingly the case in Washington (Section 10.4.4.4).

10.4.4.2 Project Construction: Direct Jobs Overstated

The BERK Study uses the Washington State Input-Output Model to estimate impacts on employment (and other economic effects).[436] For specialized construction projects such as Millennium, input-output analysis can substantially overestimate jobs, especially for direct on-site construction. Input-output models typically provide only limited disaggregation for the large and diverse construction industry. The Washington State Input-Output Model groups all construction together into one sector.[437] But compared with other types of construction, energy-related projects, and especially projects like

Millennium, are very specialized, distinctive, and atypical; energy projects result in fewer jobs per dollar spent, but the jobs on site can be highly paid.

Simply put, construction labor expenditures on energy-related projects result in a small number of highly-paid direct on-site construction jobs. However, if construction labor expenditures are input into an I-O model with a more generic construction sector, the model will estimate a higher number of lower-paid construction jobs (relative to the lower number of higher-paid construction jobs resulting from a typical energy-related project).

The BERK Study estimates for Project construction would result in:

- 1350 direct jobs;
- $70 million in direct labor income;
- about $52,000 labor income[438] per direct job;
- 1300 temporary indirect and induced jobs;
- $65 million in labor income for indirect and induced jobs; and
- about $50,000 labor income per indirect and induced job.

It is notable that labor income per indirect and induced job ($50,000) is almost as high as labor income per direct construction jobs (about $52,000). For projects like Millennium, labor income per job-year tends to be significantly higher for direct construction jobs than for indirect and induced jobs. Construction jobs on projects like Millennium include a sizable share of high skill trades that are typically highly compensated. Meanwhile, induced jobs include a sizable share of service jobs (such as in retail and food service) that are generally much less highly compensated.

The economic impacts study provided by the proponent for the Tesoro Savage Vancouver Energy Distribution Terminal project estimated labor income per direct construction job would be almost $100,000.[439] Hence, Tesoro Savage estimated that wages per direct construction job would be about twice what was estimated by Millennium. The Tesoro Savage estimate is much more consistent with typical wages for construction of energy projects including a sizable share of high skill trades that are highly compensated. Put simply, constructing these projects typically results in relatively few jobs, but at least some of these jobs are highly compensated.

The above analysis demonstrates that the BERK study estimates of direct construction jobs (1350) substantially overstates the number of direct job-years that could result from the Millennium Project.

10.4.4.3 Project Operations

As explained in the DEIS and NEPA DEIS, the BERK Study assumes wages for Project operations which are much higher than likely; hence, this assumption also contributes to BERK's overstatement of the estimated economics impacts:[440]

> The wage information used in this analysis provided by the Applicant relies on wage data based on the International Longshore and Warehouse Union average salaries for the entire West Coast. Wages in Cowlitz County would likely be lower than the West Coast averages used in the economic impact analysis and overall economic impacts would also be lower. For instance, the economic impact analysis assumed direct wages of approximately $118,000 per employee, exclusive of benefits. This is not representative of actual wages likely at the terminal and likely overstates the economic output.
>
> For comparison, the average annual wage for workers in transportation and material moving occupations, which would be similar to the type of occupational employment created by the terminal, was $38,730 in Cowlitz County in 2014 according to the U.S. Bureau of Labor Statistics State Occupational Employment and Wage Estimates for Washington State. Wages reported in the State Occupational Employment and Wage Estimates do not include employer costs for benefits.

In particular, to the extent that the BERK Study has overestimated labor income from direct operating jobs, this will also result in an overestimate of spin-off jobs.[441]

10.4.4.4 I-O Tends to Overstate Employment Impacts in a Tighter Labor Market

Another key limitation of I-O models is that they are highly simplified representations of how the economy actually operates, and the results of these models tend to represent the higher end of a range of potential employment impacts. The reason for this is that I-O models assume that there will be no supply constraints for labor and other resources and that people employed as a result of the proposed project would otherwise be unemployed.

Employment impact estimates generated with I-O models tend to overstate actual net job impacts, especially in a context of tighter labor market conditions. When the economy is closer to full employment (as is increasingly the case in Washington), I-O models will tend to overestimate employment impacts, and particularly overstate spin-off effects. This is especially true for induced jobs (employment impacts from spending of labor income). Impacts from spending of labor income are typically the most challenging to meaningfully model, and they are especially difficult to meaningfully model in a context of tighter labor market conditions.

Put another way, when the economy is closer to full utilization of available workers and other resources, overall economic activity and employment are constrained. Adding a new activity (such as an energy-related project) is more likely to displace some other new or existing activity, such that the potential net increase in jobs due to the new activity will be less than estimated by an I-O model.

Given a context of tighter labor market conditions, employment impacts in Washington will tend to be at the lower end of the range for Millennium. Hence, it is realistic to assume that Millennium Project construction and operations would actually result in employment impacts that are at the lower end of the range for direct, indirect, and total job-years.

10.5 Jobs Outside of Washington

10.5.1 Introduction

As discussed in 10.4.3.1, the BERK Study assumed that the coal handled by the Project would be produced even without the Project; hence, the jobs and business activity associated with mining and transportation of the coal are likely to occur regardless.[442] The Complaint, however, refers to jobs and other benefits throughout the US (and specifically in MT and WY) relating to coal exports (¶¶75-77). So in the Complaint, Lighthouse is relying upon BERK (its own study) to claim job impacts in Washington, and then contradicting its own study to claim job impacts outside Washington.

To respond to this claim in the Complaint, and in keeping with our conservative approach, TGG has analyzed the potential job impacts of the Project outside of Washington. As discussed in Section 10.3, job impacts are a useful indicator of the broader economic benefits of projects, such as Millennium. To provide a fuller consideration of the broader potential economic benefits of Millennium, this section will evaluate mining jobs and spin-offs outside of Washington, related to the Project. Our review of jobs outside Washington evaluates mining job impacts in Montana and Wyoming, the states of origin for most (if not all) of coal to be exported from the Project. TGG demonstrates job impacts outside Washington related to the Project are also very small in the context of the Montana and Wyoming economies and extremely small in the context of the entire US economy.

Section 10.5.2 discusses our central finding that jobs outside Washington range from small to non-existent. We also discuss the throughput assumptions for coal exports via Millennium that underpin this central finding. Section 10.5.3 provides key findings from

TGG's initial evaluation of the job impacts outside Washington based on the maximum throughput assumption (44 MMTPY). These key findings summarize how small these impacts are in the context of the state and national economies.

Section 10.5.4 explains TGG's approach to our initial evaluation of the job impacts outside Washington, our sources, as well as the assumptions underlying our estimates. In particular, we examine the relevance of the three main industry-friendly sources on which we have relied to undertake this analysis. Section 10.5.5 summarizes TGG's initial higher job impacts estimates based on a study by the National Mining Association cited in the Complaint. Similarly, Section 10.5.6 summarizes TGG's initial lower job impacts estimates based on two state-specific studies for Montana and Wyoming respectively. Section 10.5.7 explains of TGG's assumptions regarding Montana's and Wyoming's respective shares of the Project's exports at full throughput. This somewhat arbitrary assignment of a higher share to Montana is conservative and will tend to overstate the job impacts of the Project. Finally Section 10.5.8 further explains why the TGG's initial estimates for the mining job impacts in Section 10.5.5 and 10.5.6 are likely overstated. And Section 10.5.9 concludes that based on more realistic throughput assumptions, total mining job impacts related to Millennium are also very small **(to non-existent)** in the context of the Montana and Wyoming state economies. Moreover, these jobs are tiny **(to non-existent)** in the context of the US economy.

10.5.2 Central Finding: Jobs Outside Washington Range from Small to Non-Existent

TGG uses as a starting point for our analysis the maximum throughput assumption for coal exports via Millennium of 44 MMTPY during Stage 2 Full-Build-Out Operations in 2028). As discussed in Section 10.4.3.3, the Project is unlikely to consistently operate at a level close to this throughput assumption. Moreover, the range of potential throughput is very large, with 0 MMTPY as the lower limit of the Project's potential throughput and 44 MMTPY as the upper limit. As will be further explained in Section 10.5.9, a key driver of job impacts outside Washington is the incremental volume of coal produced as a result of the Project. It is possible that under some market conditions there will be no coal exported via the Project. As such TGG estimates a range of 0 to 44 MMTPY of coal that could be produced because of the Project.

Given that mining jobs from exports are estimated to be directly proportional to the tonnage of exports, mining jobs decline proportionally to coal produced for export from Millennium. If there are no coal exports from Millennium, there will be no mining job impacts outside Washington. **Under the more realistic assumption of a throughput range of 0 to 44 MMTPY, (in which it is unlikely for the Project to operate consistently close to full throughput), mining jobs related to Millennium will be small to non-existent.**

10.5.3 Key Findings Based on Maximum Throughput Assumption (44 MMTPY)

TGG's initial evaluation of jobs outside Washington, as described in Sections 10.5.4 to 10.5.8, is based on the maximum throughput assumption of 44 MMTPY as a starting point. As discussed above, 44 MMTPY is an upper limit for the potential throughput and it is unlikely that the Project would operate consistently at (or close to) this level. Nonetheless, even using the assumption of the upper limit of 44 MMTPY, TGG's initial evaluation concludes that total mining jobs related to Millennium are very small.

TGG's evaluation (based on a National Mining Association Study cited by Lighthouse in the Complaint) estimates that there would be 1,370 direct mining jobs in Montana and 274 direct mining jobs in Wyoming related to the Project at full throughput (44 MMTPY). Using lower estimates from state-specific studies, TGG estimates that there would be 590 direct mining jobs in Montana and 212 direct mining jobs in Wyoming. We conclude that the mining jobs related to Millennium are very small in the context of the Montana and Wyoming economies. And they are extremely small in the context of the entire US economy.

Based on higher estimates from the National Mining Association Study, total mining jobs (including spinoff jobs) for Montana and Wyoming would be 3,672 jobs/year. This is the **equivalent of 0.34% of all jobs in these states**; and **0.0029% of all US jobs**.

Using lower estimates from state-specific studies, total mining jobs (including spinoff jobs) for Montana and Wyoming would be 2,063 jobs/year. This is the **equivalent of 0.19% of all jobs in these states**; and **0.0014% of all US jobs**.

Mining jobs based on the lower estimates are about half of the mining jobs based on higher estimates. However, even using the higher estimates, total mining jobs are less than 0.5% of total jobs in Montana and Wyoming respectively and combined. So even the higher estimates result in very small job impacts in Montana and Wyoming. And these impacts are tiny in the context of the entire US economy.

As detailed in Section 10.4.2, Project construction and subsequent operations at full throughput would result in only a few hundred jobs per year in Washington (based on the overstated results from the BERK Study). Potential jobs from the Project would be less than 0.01% of total Washington jobs and possibly considerably less. Based on the Plaintiffs' own overstated estimates with a maximum throughput assumption of 44 MMTPY, total jobs in Washington from Millennium are very small in the context of the state economy. Similarly, based on a maximum throughput assumption of 44 MMTPY and industry-friendly studies to estimate job impacts outside Washington, total mining jobs in Montana and Wyoming related to Millennium are also very small in the context of these state economies, and tiny in the context of the US economy.

However, based on a more realistic throughput assumption range of 0 to 44 MMTPY, total jobs in Washington from Millennium are very small in the context of the state economy. Similarly, total mining jobs in Montana and Wyoming related to Millennium are also very small **(to non-existent)** in the context of these state economies, and tiny **(to non-existent)** in the context of the US economy.

10.5.4 TGG's Approach to Evaluate Job Impacts Outside Washington

This section will detail TGG's approach to our initial evaluation of the job impacts outside Washington, our sources, as well as the assumptions underlying our estimates.

The Complaint in federal litigation refers to jobs and other benefits throughout the US (and specifically in MT and WY) relating to coal exports (¶¶75-77). In particular, Lighthouse's claims that the Project would "bring substantial benefits to the economies of Washington's sister states, including Montana and Wyoming" (¶75).

To evaluate Lighthouse's claims, we reviewed Lighthouse's supporting sources (cited in the footnotes of ¶75 and ¶77). The following studies cited in the Complaint are of particular relevance for our evaluation of job impacts outside Washington:

- Ernst & Young, U.S. Coal Exports: National and State Economic Contributions, Prepared for the National Mining Association, May 2013. [referenced in footnote 11 of the Complaint]; referred to in this report as "the NMA Study."[443]

- Robert Godby et al., Centre for Energy Economics and Public Policy, The Impact of the Coal Economy on Wyoming, Prepared for Wyoming Infrastructure Authority, February 2015. [referenced in footnote 16 of the Complaint]; referred to in this report as "the CEE Study."[444]

A third study, not cited in the Complaint, is of particular relevance to the evaluation of mining job impacts in Montana:

- Barkey, Patrick S., Bureau of Business and Economic Research, The Economic Impact of Increased Production at the Spring Creek Mine, Prepared for Montana Chamber of Commerce, October 2012; referred to in this report as "the BBER Study."[445]

The BBER Study analyzes expanded coal production at Spring Creek mine for export to Asia via Pacific Northwest terminals:

> This report summarizes the findings of an investigation into the likely impacts on the Montana economy of a significant expansion in coal production at the Spring Creek mine operated by Cloud Peak Energy near Decker, Montana.
> (BBER Study, p. 3)

The Spring Creek Mine is in Montana Powder River Basin. The type of coal production at this mine is highly representative of the coal that might be exported via Millennium.[446] The study analyzed the employment impacts "that would result from a hypothetical 20 million tons per year increase in mine output." (BBER Study, p. 3).[447]

At full throughput, the Project would export 44 MMTPY of coal.[448] As further detailed in Section 10.5.5, of these 44 MMTPY of coal exports, TGG has assumed a distribution of 33 MMTPY from Montana coal production and 11 MMTPY from Wyoming. Hence, for estimating the job impacts of 33 MMTPY of coal exports from Montana, we have scaled the BBER Study results. Likewise, we have scaled the CEE Study results for estimating the job impacts of the 11 MMTPY of coal exports from Wyoming.[449]

Finally, it should be understood that each of these three studies has been prepared on behalf of groups that are supportive of coal production and exports (National Mining Association, Wyoming Infrastructure Authority and Montana Chamber of Commerce). As noted, two of the three supporting studies are cited by Lighthouse in the Complaint itself as supportive of their claims of employment benefits from the Project. The BBER Study, while not cited in the Complaint, was produced on behalf of the Montana Chamber of Commerce, which is a member of industry groups supportive of the Project.

This reliance on industry-friendly sources is consistent with TGG's conservative approach. As described in Section 3.2.4, TGG has undertaken an analysis that is both rigorous and conservative (i.e. does not understate the potential for coal exports via Millennium and the associated benefits). In an effort to be conservative in our evaluation of the employment impacts outside Washington, we have extensively reviewed industry-friendly sources and based much of our analysis on the three sources cited above. This approach is also consistent our analysis of the employment impacts of the Project in Washington. As detailed in Section 10.4, TGG relied extensively on information from the Plaintiffs' own studies, particularly the BERK Study, in our review of the employment benefits of the Project.

10.5.5 Initial Higher Job Impacts Estimates Based on the NMA Study

Table 7 provides the summary of TGG's initial higher job impacts estimates based on the NMA Study. Details regarding the data, assumptions, and methodology underlying these estimates are then provided.

As indicated in the previous section, the NMA Study is cited in the Complaint in federal litigation in regard to job impacts outside Washington. The study reviews the national and state economic contributions of the coal industry.

Based on the NMA Study, TGG's initial higher job impacts estimates outside Washington at full throughput are summarized in Table 7 below. These summary estimates are as follows:

- total mining jobs (including spin-offs) for Montana and Wyoming would be 3,672 jobs/year (1,644 direct jobs and 2,028 indirect and induced jobs); this is the equivalent of 0.34% of all jobs in these states; and 0.0029% of all US jobs;
- total mining jobs (including spin-offs) for Montana would be 2,987 jobs/year (1,370 direct jobs and 1,671 indirect and induced jobs); this is the equivalent of 0.44% of all Montana jobs;
- total mining jobs (including spin-offs) for Wyoming would be 685 jobs/year (274 direct jobs and 411 indirect and induced jobs); this is the equivalent of 0.17% of all Wyoming jobs.
- total mining jobs (including spin-offs) per MMTPY[450] for Montana and Wyoming would be 83 (37 direct jobs per MMTPY and 46 indirect and induced jobs);
- total jobs (including spin-offs) per MMTPY for Montana would be 91 (42 direct jobs per MMTPY and 49 indirect and induced jobs);
- total jobs (including spin-offs) per MMTPY for Wyoming would be 61 (24 direct jobs per MMTPY and 37 indirect and induced jobs).

As emphasized in Section 10.5.2, even the initial higher job impacts estimates are very small. Total mining jobs are less than 0.5% of total jobs in Montana and Wyoming respectively and combined. So even the higher estimates result in very small job impacts in Montana and Wyoming. And these impacts are tiny in the context of the entire US economy.

Table 7: Initial Higher Job Impacts Estimates Based on the NMA Study

Mining-related Jobs for exports (44 MMTPY)

	Exports MMTPY	Direct	Indirect & Induced	Total	All Jobs BEA 2017	Mining Jobs as % of All Jobs Direct Mining	Total Mining
Montana	33	1370	1617	2987	675,904	0.2027%	0.4419%
Wyoming	11	274	411	685	398,199	0.0688%	0.1720%
Montana+Wyoming	44	1644	2028	3672	1,074,103	0.1531%	0.3419%
Other States	44	0	2113	2113	195,058,097	0.0000%	0.0011%
All US	44	1644	4141	5785	196,132,200	0.0008%	0.0029%

Jobs per MMTPY

	Direct	Indirect & Induced	Total	Multiplier Total/Direct
Montana	42	49	91	2.18
Wyoming	24	37	61	2.50
Montana+Wyoming	37	46	83	2.23
Other States	0	48	48	N/A
All US	37	94	131	3.52

Source: NMA Study (see Section 10.5.4).[451]

Details regarding the data, assumptions, and methodology underlying the estimates in Table 7 are provided in endnote 451.

For various reasons, described in Section 10.5.8, the spin-off estimates for job impacts outside MT and WY may overstate jobs in other states, as well as the US estimates. Moreover, the Table 7 estimates based on the NMA Study likely overstate the direct job impacts related to the Project especially in Montana.[452] Endnote 452 explains the cause of this likely overstatement in more detail.

10.5.6 Initial Lower Estimates from the State-Specific Studies for Montana and Wyoming (BBER and CEE Studies)

Table 8 provides the summary of TGG's initial lower job impacts estimates based on two state-specific studies for Montana and Wyoming respectively: the BBER and CEE Studies. Details regarding the data, assumptions, and methodology underlying these estimates are then provided.

As discussed in Section 10.5.4, the CEE Study is cited in the Complaint in reference to the economic (including employment) benefits of Wyoming coal production (as a footnote to ¶77). The CEE Study specifically analyzes job impacts of coal production in Wyoming for export to Asia via Pacific Northwest terminals, but this analysis of exports is not discussed in the Complaint in federal litigation.

The BBER Study is not cited in the Complaint. This study is, however, particularly relevant to our evaluation of the Montana mining job impacts. The BBER study analyzes a major expansion of coal production at Spring Creek Mine in the Powder River Basin for export to Asia via Pacific Northwest terminals. The type of coal production at this mine is representative of the coal that might be exported via Millennium (notably in a scenario where Millennium operates at full throughput of 44 MMTPY).

Based on the BBER Study for Montana and the CEE study for Wyoming, TGG's initial lower job impacts estimates outside Washington at full throughput are summarized in Table 8 below. These summary estimates are as follows:

- total mining jobs (including spin-offs) for Montana and Wyoming would be 2,063 jobs/year (1,262 direct jobs and 802 indirect and induced jobs); this is the equivalent of 0.19% of all jobs in these states; and 0.0014% of all US jobs;
- total mining jobs (including spin-offs) for Montana would be 1,571 jobs/year (590 direct jobs and 981 indirect and induced jobs); this is the equivalent of 0.23% of all Montana state jobs;
- total mining jobs (including spin-offs) for Wyoming would be 493 jobs/year (212 direct jobs and 281 indirect and induced jobs); this is the equivalent of 0.12% of all Wyoming state jobs.
- total mining jobs (including spin-offs) per MMTPY for Montana and Wyoming would be 47 (18 direct jobs per MMTPY and 29 indirect and induced jobs);
- total jobs (including spin-offs) per MMTPY for Montana would be 48 (18 direct jobs per MMTPY and 30 indirect and induced jobs);
- total jobs (including spin-offs) per MMTPY for Wyoming would be 44 (19 direct jobs per MMTPY and 25 indirect and induced jobs).

As noted in Section 10.5.2, total mining jobs based on the lower estimates are about half of the mining jobs based on higher estimates. So, at the lower estimates, total mining jobs are less than 0.25% of total jobs in Montana and Wyoming respectively and combined (see Table 8). Even using the higher estimates, total mining jobs are less than 0.5% of total jobs in Montana and Wyoming respectively and combined. Both the lower and higher estimates result in very small job impacts in Montana and Wyoming. And these impacts are even tinier when spread across the entire US economy.

While small job impacts have been estimated based on both the NMA Study (Table 7) and the state-specific studies (Table 8), TGG concludes that the state-specific studies are more accurate and reliable sources for estimating the mining job impacts of the Project in Montana and Washington.

As explained in Section 10.5.5, the NMA Study likely overstates the direct job impacts related to the Project, particularly in Montana. The NMA methodology estimates job impacts for all of US and for each state, based on limited state-level detail. State-specific studies and data can provide more state detail and more accuracy. For instance, as indicated above, the BBER study analyzes a major expansion of the Spring Creek Mine in the Powder River Basin. The type of coal production at this mine is highly representative of the coal that might be exported via Millennium (notably at full throughput). Similarly, the CEE Study specifically analyzes job impacts of coal production in Wyoming for export to Asia via Pacific Northwest terminals.

These two state-specific studies have been prepared by economists at the University of Montana and the University of Wyoming, respectively, and have more state-specific and regional detail than the NMA study.

Another result that further validates the two regional studies is the close similarity between estimates of total jobs (including spin-offs) per MMTPY for each state from each respective study. Based on the BBER Study, total jobs (including spin-offs) per MMTPY for Montana would be 48. And based on the CEE study, total jobs (including spin-offs) per MMTPY for Wyoming would be 44.

We note that the BBER Study estimated job impacts using REMI (Regional Economic Models, Inc.), which incorporates aspects of the input-out model approach.[453] The CEE Study estimated job impacts using a modified version of IMPLAN, customized with state-specific data for Wyoming.[454] TGG estimated jobs per MMTPY in Montana and Wyoming respectively based on two independent studies (BBER and CEE), using two different methodologies in two different states. And the total jobs (including spin-offs) were almost the same in each state (48 jobs per MMTPY in Montana and 44 jobs per MMTPY in Wyoming). Intuitively, this makes sense. As explained in Section 10.5.5, coal exported via the Project would typically be produced at large PRB surface mines, which have similar characteristics in both states. Moreover, the Montana mine analyzed in the BBER study (Spring Creek) is located just north of the Wyoming border. [455]

We note that this similarity of results is not the case in the NMA Study where total jobs (including spin-offs) per MMTPY are estimated at 91 for Montana and 61 for Wyoming. As discussed above and in Section 10.5.5, the NMA Study likely overstates the job impacts (direct and spin-offs) related to the Project, particularly in Montana.

Table 8: Initial Lower Job Impacts Estimates Based on State-Specific Coal Studies for Montana and Wyoming

Mining-related Jobs for exports (44 MMTPY)

	Exports MMTPY	Direct	Indirect & Induced	Total	All Jobs BEA 2017	Mining Jobs as % of All Jobs: Direct Mining	Mining Jobs as % of All Jobs: Total Mining
Montana	33	590	981	1571	675,904	0.0872%	0.2324%
Wyoming	11	212	281	493	398,199	0.0532%	0.1237%
Montana+Wyoming	44	802	1262	2063	1,074,103	0.0746%	0.1921%
Other States	44	0	757	757	195,058,097	0.0000%	0.0004%
All US	44	802	2019	2820	196,132,200	0.0004%	0.0014%

Jobs per MMTPY

	Direct	Indirect & Induced	Total	Multiplier Total/Direct
Montana	18	30	48	2.66
Wyoming	19	25	44	2.32
Montana+Wyoming	18	29	47	2.57
Other States	0	17	17	N/A
All US	18	46	64	3.52

Source: BBER Study (Montana) and CEE Study (Wyoming).[456] [457]

Details regarding the data, assumptions, and methodology underlying the estimates in Table 8 are provided in endnote 457.

As indicated above, TGG concludes that the state-specific studies are more accurate and reliable sources for estimating the mining job impacts of the Project in Montana and Washington. Nonetheless, as will be discussed in Section 10.5.8, both the state-specific studies include approaches that may tend to overstate job impacts in a tight economy.

10.5.7 Distinction of Montana Vs Wyoming Share of Millennium Coal Exports

As noted in Section 10.5.5, TGG has assumed that Montana's share of the 44 MMTPY (i.e. Project's exports at full throughput) is 33 MMTPY while Wyoming's share is 11 MMTPY. This assumption is based on the percentage of each state's share of US exports as provided in the NMA Study.[458] This assumed distribution of the exports via the Project is somewhat arbitrary. By assigning a higher percentage to Montana's share, TGG is being conservative. According to the NMA study, job estimates per MMTPY in Montana (91 jobs/MMTPY) are considerably higher than those for Wyoming (61 jobs/MMTPY). As such, this distribution will tend to overstate the overall job impacts (for both states) related to the Project.

As explained in Sections 4.7 and 4.8, Wyoming is the largest coal producing state by a considerable margin and a much larger producer than Montana.[459] Almost all the coal produced in Wyoming is used domestically (mainly for thermal power plants). If there were a higher demand for more PRB coal for export from the Project, it is possible that Wyoming's share of the exports could increase. Based on the NMA study, jobs per MMTPY in Wyoming are significantly lower those in Montana. Based on the state-specific studies, jobs per MMTPY in Wyoming are only slightly lower.[460]

By selecting the distribution of 33 MMTPY for Montana and 11 MMTPY, TGG chose the higher end of Montana's share in order to be conservative (i.e. not to understate the job impacts). However, even if some of the share shifts to Wyoming, the mining job impacts related to the Project will not change greatly.

10.5.8 Initial Estimates for Mining Job Impacts (Using 44 MMTPY Assumption) Likely Overstated

TGG has conducted its initial evaluation of total mining jobs based on a maximum throughput assumption (44 MMTPY) and industry-friendly studies. Our evaluation has concluded that total mining jobs in Montana and Wyoming related to Millennium are very small in the context of these state economies, and tiny in the context of the US economy. Moreover, these very small mining job estimates are likely overstated due to our reliance on NMA and state-specific studies for the following reasons.

10.5.8.1 Higher Estimates Based on NMA Study Are Overstated and Unreliable

In our analysis of the job impacts in Washington, Section 10.4.4 describes why Lighthouse's estimates are overstated and should not be relied upon. Similarly, the higher estimates from Table 7 (based on the NMA Study) are also likely overstated and should not be relied upon.

In Section 10.5.5, we discussed how the Table 7 estimates based on the NMA Study likely overstate the direct job impacts related to the Project in Montana and Wyoming. We also conclude that for various reasons, the spin-off estimates for job impacts outside Montana and Wyoming may overstate jobs in other states, as well as the US estimates.

As discussed in Section 10.5.6, the state-specific studies are more accurate and reliable sources for estimating the mining job impacts of the Project in Montana and Wyoming. Therefore the lower job impacts estimates based on state-specific studies (as provided in Table 8) are also more accurate and reliable.

10.5.8.2 Estimates from all Studies (NMA, CEE and BBER) Overstate Employment Impacts in a Tight Economy

Nonetheless, both the state-specific studies include approaches that may tend to overstate job impacts in a tight economy. Section 10.4.4.4 explains why I-O models tend to overstate employment impacts in a tighter labor market, especially for spin-offs. When the economy is closer to full utilization of available workers and other resources, overall economic activity and employment are constrained.

Given a context of tighter labor market conditions, employment impacts in Washington will tend to be at the lower end of the range for Millennium. Hence, it is realistic to assume that Millennium Project construction and operations would actually result in employment impacts that are at the lower end of the range for direct, indirect, and total job-years.

Similar to Washington, the Montana economy has a relatively tight labor market. Therefore, the jobs estimated for Montana (especially those based on the NMA Study, which uses IMPLAN) could also be overstated.

Unlike Washington (and Montana), the Wyoming economy has more slack, particularly in the sectors and regions more connected with coal-mining. However, given the use of I-O models in the NMA Study, the national impact (and particularly the national spin-off jobs) from the Montana and Wyoming mining jobs in both Table 7 and Table 8 may also be overstated, particularly when dispersed throughout the whole US economy, which currently has a fairly tight labor market.

10.5.8.3 Industry-Friendly Sources Tend to Overstate Employment Benefits of Coal

Finally, as discussed in Section 10.5.4, in an effort to be conservative in our evaluation of the employment impacts outside Washington, we have based much of our analysis on the three industry friendly sources (NMA Study, CEE Study and BBER Study).

10.5.9 Based on a More Realistic Throughput Assumption, Mining Jobs are Small to Non-Existent

The very small mining job estimates (from TGG's initial evaluation) are even further overstated due to the initial maximum throughput assumption (44 MMTPY). Based on a more realistic throughput assumption range of 0 to 44 MMTPY, TGG concludes that total mining jobs in Montana and Wyoming related to Millennium are also very small **(to non-existent)** in the context of these state economies, and tiny **(to non-existent)** in the context of the US economy.

As discussed in Section 10.5.2, a key driver of job impacts outside Washington is the incremental volume of coal produced as a result of the Project. Section 7 concludes that the US will not export large volumes of thermal coal to Asia via Millennium because supply from the US will not be generally economically competitive in destination markets. And there are a number of other existing port alternatives that can meet the intermittent and shrinking Asian demand for US thermal coal exports. Therefore the Project is unlikely to consistently operate at levels close to the 44 MMTPY maximum throughput assumption.

In fact, it is possible that under some market conditions, there will be no coal exported via the Project. As such TGG estimates a range of 0 to 44 MMTPY of coal that could be produced because of the Project. TGG estimates that mining jobs from exports are directly proportional to the tonnage of exports. This is consistent with the assumptions of the NMA, CEE, and BBER studies.[461] For example, with Millennium throughput at one-quarter of full capacity (11 MMTPY), there would be one-quarter the mining jobs estimated for Millennium throughput at full capacity (44 MMTPY). And if there are no exports from the Project, there will therefore be no mining jobs as a result of the Project.

Given that the Project is unlikely to consistently operate at levels close to 44 MMTPY, TGG's initial estimates based on maximum (44 MMTPY) throughput (Sections 10.5.5 and 10.5.6) will result in a considerable overstatement of the out-of-state mining job impacts.

And to the extent that Millennium is constructed and operates, some (and possibly all) of the tonnage handled may be diverted from port alternatives. Tonnage diverted to Millennium from port alternatives will not require additional US coal production. The coal that would have been produced, even without Millennium, would still be produced. All that would change is how this coal is shipped from the mine to market, such that coal is shipped via Millennium instead of a port alternative. Tonnage diverted to Millennium from port alternatives would not result in additional mining jobs.[462] **This scenario of no additional mining jobs is consistent with the assumption in the Plaintiffs' BERK Study (as discussed in 10.4.3.1). According to BERK, the coal handled by the Project would be produced even without the Project; hence, the jobs and business activity associated with mining and transportation of the coal are likely to occur regardless.**

In light of the above, TGG concludes that job impacts outside Washington will range from very small to non-existent.

11 Attestation

I declare under penalty of perjury that the foregoing (this report including Endnotes/ Technical Appendix) is true and correct to the best of my knowledge. Executed this 14th day of November, 2018, at Berkeley, California.

Ian Goodman

Ian Goodman,
President, The Goodman Group, Ltd.

12 Endnotes / Technical Appendix

[1] Millennium Bulk Terminals-Longview SEPA Draft Environmental Impact Statement, April 2016. http://www.millenniumbulkeiswa.gov/sepa-draft-eis.html

[2] Millennium Bulk Terminals-Longview SEPA Final Environmental Impact Statement, April 2017. http://www.millenniumbulkeiswa.gov/sepa-eis.html

[3] Millennium Bulk Terminals-Longview NEPA Draft Environmental Impact Statement, September 2016. http://www.millenniumbulkeiswa.gov/nepa-draft-eis.html

[4] See endnote 422.

[5] See Section 10.5.4 for a discussion of the three industry-friendly studies in question.

[6] In comments on the Millennium DEIS, Millennium and Cloud Peak Energy referred to, relied upon, and attached various IEA reports. FEIS Vol. IV: Comments on the Draft EIS, General Public Part 3, Millennium Bulk Terminals, June 13, 2016 (Comment 3070), pp. 38-40, 186-187, 211, 217-223, 241-242 (pdf). http://www.millenniumbulkeiswa.gov/assets/07-volume-iv-appendix-b-general-public-part-32.pdf;

FEIS Vol. IV: Comments on the Draft EIS, General Public Part 2, Cloud Peak Energy, June 10, 2016 (Comment 2447), pp. 312, 317-445 (pdf). http://www.millenniumbulkeiswa.gov/assets/07-volume-iv-appendix-b-general-public-part-22.pdf

Put simply, in this report, TGG has referred to and relied upon IEA and EIA sources and specific reports that were also relied upon by industry to evaluated Millennium and other port projects.

[7] See for example:

Goodman, Ian, Expert Testimony on the Need for the Vancouver Energy Distribution Terminal (VEDT), State of Washington Energy Facility Site Evaluation Council (Case No. 15-001); Application No. 2013-01 of Tesoro Savage LLC Vancouver Energy Distribution Terminal; Earthjustice; May 13, 2016 (with in-depth participation of B. Rowan). http://www.thegoodman.com/pdf/161004005629_TGG20160512_Earthjustice_VEDTDirectTest.pdf

Goodman, Ian and Brigid Rowan, Economic Costs and Benefits of the Trans Mountain Expansion Project (TMX) for BC and Metro Vancouver in collaboration with The Centre for Public Policy Research, Simon Fraser University, November 10, 2014, re-released February 4, 2015. http://www.thegoodman.com/pdf/TGG20150204_SFU_EconCostBen_TMX.pdf

[8] TGG has provided economic reports and expert testimony on the most controversial crude oil transport (rail, marine, pipeline, and terminals) projects in North America, including Tesoro Savage Vancouver Energy Distribution Terminal, Valero Benicia Crude by Rail Project, TransCanada's Keystone XL and Energy East, Enbridge's Line 9 and Kinder Morgan's Trans Mountain Expansion Project.

[9] See for example, endnotes 275 and 428.

[10] See Sections 4.3, 4.7 (specifically endnote 40) and Sections 5.3-5.5.

[11] When source data for tonnage relates to an annual period (such as MMst annual coal production), a conversion to MMTPY is sometimes provided to facilitate comparison with Millennium Project throughput.

[12] This paragraph provides sources for the entire paragraph. 1 Mtce = 0.7 Mtoe (million tonnes oil equivalent) = 27,778 GBtu; hence, 1 Mtce = 1 million tonnes of coal with thermal content of 12,600 Btu/lb (7000 kcal/kg). For coal with lower heat content, the weight of 1 Mtce is higher. For example, 1 Mtce per year = 1.355 MMTPY (for Montana Powder River Basin 9300 Btu/lb coal) and 1.5 MMTPY (for Wyoming Powder River Basin 8400 Btu/lb coal). See endnote 45 and IEA WEO 2017 (Section 1.5.5), pp. 739-740.

[13] Thermal coal, also referred to as steam coal, is burned (primarily in boilers to generate steam) for the production of electricity (primarily through steam turbines) or for process heating purposes, or used for direct combustion heating.

[14] Metallurgical coal, also referred to as met coal or coking coal, is heated in coke ovens to produce metallurgical coke, a hard porous residue. This coke is used primarily as a fuel and a reducing agent in a blast furnace during the smelting of iron ore into iron before it is converted into steel.

[15] In addition to the three main ranks, anthracite coal, also referred to as hard coal, is a fourth smaller coal rank. Compared with other coal, anthracite:

- has the highest heat content and hardness, and lowest moisture content, and
- now makes up a very small portion of overall coal production and consumption because of its high cost.

https://www.eia.gov/energyexplained/index.php?page=coal_home

> Anthracite accounted for less than 1% of the coal mined in the United States in 2016. All of the anthracite mines in the United States are in northeastern Pennsylvania. Anthracite is mainly used by the metals industry.

[16] Equivalent to ~20.5-26.0 MMBtu/ton (Million Btu per ton), or ~5700-7200 kcal/kg (kilocalorie/kilogram). These data are based on heat content assumed in the FEIS

(SEPA Coal Market Assessment Technical Report, p. 4-41); other sources assume heat content of 10,500-14,000 Btu/lb, on a moist, mineral-matter-free basis.

[17] Inherent moisture by weight.

[18] Equivalent to ~15.0-20.5 MMBtu/ton, or ~4200-5700 kcal/kg. These data are based on heat content assumed in the FEIS (SEPA Coal Market Assessment Technical Report, p. 4-41); other sources assume heat content of 8,300-11,500 Btu/lb, on a moist, mineral-matter-free basis.

[19] Equivalent to less than 15.0 MMBtu/ton, or less than ~4200 kcal/kg. These data are based on heat content assumed in the FEIS (SEPA Coal Market Assessment Technical Report, p. 4-41); other sources assume heat content of less than 8,300 Btu/lb, on a moist, mineral-matter-free basis.

[20] These characteristics include: volatility (which affects coke yield); the level of impurities (which affects coke quality); composition (which affects coke strength); and basic characteristics (which affect coke oven safety). Metallurgical coal has a high heat content, but its optimal content of sulfur, moisture, and ash should be as low as possible. Reserves of metallurgical coal are much scarcer globally than reserves of thermal coal. In the US and globally, the large majority of coal produced and consumed is thermal coal; metallurgical coal is a relatively low portion of total coal production.

[21] After coal is removed from the ground, it may be processed and cleaned to remove rocks, dirt, sulfur, ash, and other unwanted materials. Coal mined east of the Mississippi River (notably Appalachian and Illinois Basins) is primarily metallurgical coal and/or from underground mines, and is typically processed and cleaned to some extent. Coal mined west of the Mississippi River is almost exclusively thermal coal, mostly from surface mines, and is generally not processed or cleaned after mining.

[22] There are various regional definitions for various purposes, and it should be generally understood that US coal production is largely in the interior areas between the East Coast and West Coast. For the purposes for this report, Appalachia is the area in the Eastern US, roughly coinciding with the Appalachian Basin (a production region for coal (and other fossil fuels, especially natural gas), as shown on Figure 1). Appalachia also roughly coincides with the Appalachian Mountains (which are between the East Coast and the Midwest and other portions of the Midcontinent).

Likewise, for the purposes of this report, the Mountain West is the area in the Western US, roughly coinciding with production areas for coal (and other fossil fuels), including the Powder River Basin, Uinta Basin, and other production areas, as shown on Figure 1. The Mountain West roughly coincides with the Rocky Mountains and nearby areas (which are between the West Coast and the Midwest and other portions of the Midcontinent). The Mountain West roughly coincides with the states of Montana, Wyoming, Utah, Colorado, New Mexico, as well as eastern Arizona, which are within the Mountain Census region. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

The Midwest and other portions of the Midcontinent include the Illinois Basin and other production areas for coal (and other fossil fuels), as shown on Figure 1.

[23] EIA, Coal Market Module of the National Energy Modeling System: Model Documentation 2018, June 2018, p. 6 (map of Alaska in original deleted; Alaska coal production is minimal and not significant for the analysis in this report); see also pp. 5, 28-29, 57-58 for additional information on production regions, including types of coal and quality.
https://www.eia.gov/outlooks/aeo/nems/documentation/coal/pdf/m060(2018).pdf

Similar content is provided in EIA, Assumptions to AEO 2018: Coal Market Module, especially pp. 4, 11-12. https://www.eia.gov/outlooks/aeo/assumptions/pdf/coal.pdf

[24] FEIS, SEPA Coal Market Assessment Technical Report, p. 2-3.
http://www.millenniumbulkeiswa.gov/assets/coal-market-assessment2.pdf

[25] This endnote provides sources for the entire paragraph. SEPA Coal Market Assessment Technical Report, pp. 2-1—2-8; Advancing U.S. Coal Exports: Draft, National Coal Council, Revision August 31, 2018, pp. 7, 9.
http://www.nationalcoalcouncil.org/studies/2018/NCC-US-Coal-Exports-2018.pdf;

The U.S. Coal Industry: Historical Trends and Recent Developments, Congressional Research Service, Report R44922, August 18, 2017, pp. 18-19:
https://www.everycrsreport.com/files/20170818_R44922_d2fde6a9ab22ed951d390af83d4d95ffc216d707.pdf

> There are two primary mining techniques used in the US: underground mining and surface mining. About 69% of US coal production comes from surface mines, with the remaining 31% from deep underground mines.
>
> […]
>
> Surface mining, also called "open-pit" or strip mining, entails blasting rock above the coal with explosives. This overburden (rock and soil) above the coal deposit is then removed with huge electric shovels and draglines to reveal the coal seam. The coal seam in a surface mine is worked in long cuts by uncovering and removing coal […]

Arch Coal, 2017 Annual Report, Form 10-K, pp. 8-12
https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

[26] This endnote provides sources for the entire paragraph. See Figure 1 and endnote 23.

[27] See sources in endnote 31, Section 1.5.5 (notably EIA and IEA coal reports), and EIA Coal Browser. https://www.eia.gov/coal/data/browser/#/topic/41?agg=0,2,1&rank=g&freq=A&start=2001&end=2017&ctype=map&ltype=pin&rtype=s&maptype=0&rse=0&pin=

[28] See endnote 33.

[29] Terminals on the Great Lakes have access to global markets via the St. Lawrence Seaway and River, with cargoes typically transloaded from Great Lakes vessels to ocean vessels in Quebec. See Section 7.7.6).

[30] EIA, Today in Energy, April 19, 2018 (Sources in original: EIA, *Quarterly Coal Report*, and U.S. Census Bureau) https://www.eia.gov/todayinenergy/detail.php?id=35852#

See also EIA, Coal Data Browser https://www.eia.gov/coal/data/browser/#/topic/41?agg=2,1,0&rank=ok&linechart=COAL.EXPORT_QTY.TOT-TOT-TOT.A~COAL.EXPORT_QTY.STM-TOT-TOT.A~COAL.EXPORT_QTY.MET-TOT-TOT.A&columnchart=COAL.EXPORT_QTY.TOT-TOT-TOT.A&map=COAL.EXPORT_QTY.STM-TOT-TOT.A&freq=A&start=2007&end=2017&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=

[31] Advancing U.S. Coal Exports: Draft, National Coal Council, Revision August 31, 2018, Appendix C, p. 64 (Source: Doyle Trading Consultants). http://www.nationalcoalcouncil.org/studies/2018/NCC-US-Coal-Exports-2018.pdf

This source also provides other information for all of Section 4.6 regarding thermal and metallurgical coal production and exports, port capacity and utilization, and logistics throughout the supply chain.

[32] U.S. Coal Exports website (sponsored by National Mining Association) http://www.uscoalexports.org/wp-content/uploads/2018/02/Coal-Port-Capacity-and-Exports-by-District-Sept-2017.pdf

Sources and notes in original:

Sources: NMA export data and analysis of company websites, media reports, John T. Boyd Co., T. Parker Host, EIA,
Norfolk Southern, Consol Energy, Kinder Morgan, Platts Coal Trader, Argus, CSX, United Bulk Terminals, Volker, Inc, Impala Coal Age, Platts, Sightline Institute, Alaska Railroad, State of Washington, Millennium Bulk Terminals Longview, LLC

*As of Sept. 2017
[1/] U.S. Census Bureau districts

For additional information on US Customs/Census Bureau Districts, see endnote 407.

Sources in the original include T. Parker Host; content providing (and relying upon) T. Parker Host estimates of US Coal Exports and Terminal Capacity include:

Finn Host, Status of U.S. Coal Exports, T. Parker Host, April 2017.
http://www.uscoalexports.org/wp-content/uploads/2018/02/Status-of-U.S.-Coal-Exports-Finn-Host-April-2017.pdf
also available at
http://www.nationalcoaltransportation.org/component/rsfiles/download-file/files?path=2017+Spring+Conference+-+Loews+Ventana+Canyon+-+Tucson+AZ%2FHostS17.pdf

Finn Host, How Much Coal Can the U.S. Export & How Much Will It Export? T. Parker Host, 2013.
http://www.thecoalinstitute.org/ckfinder/userfiles/files/Finn%20Host.pdf

Finn Host, US Export Infrastructure & Trends, T. Parker Host, 2013b.
http://www.southerncoalsconf.org/PDFs/SCC Fall13 Host.pdf

Finn Host, USEC and USG Port Capacity, T. Parker Host, 2012 Platts 35th Annual Coal Marketing Days Conference, September 20, 2012.
https://www.platts.com/IM.Platts.Content/ProductsServices/ConferenceandEvents/2012/pc226/presentations/Finn_Host.pdf

Tom Sanzillo, No Need for New U.S. Coal Ports: Data Shows Oversupply in Capacity, IEEFA (Institute for Energy Economics and Financial Analysis), November 19, 2014, p. 1, footnote 1 (underlining added for emphasis)
http://www.ieefa.org/wp-content/uploads/2014/11/Sanzillo-port-capacity.pdf:

> This paper relies heavily on Finn Host, How much coal can the U.S. Export and How Much Will it Export, T. Parker Host, un-dated. http://www.thecoalinstitute.org/ckfinder/userfiles/files/Finn%20Host.pdf. T. Parker Host is a large, venerable company providing shipping and cargo services through 75 ports in the United States. The company is involved with grain, metals and minerals shipments though most of its business comes from the coal industry. The data in this company presentation treats in a consistent methodological manner information and data that, drawn from other sources would suffer from varying accounting and statistical treatments. The data offered by T. Parker Host has been cross checked to the degree possible using Energy Information Administration (Quarterly and Annual Coal Reports), SNL Coal export import database and other coal industry sources to test for reliability.

[33] Terminal capacity estimates vary between sources, for a number of reasons including differences in Scope and Effective Maximum Throughput.

Scope: As shown by Table 1 and Table 2, some sources focus on principal terminals, while other sources include additional locations (such as Great Lakes) and smaller terminals (which may be less specialized and handle multiple commodities).

Effective Maximum Capacity (Throughput): Various sources differ in capacities estimated for specific terminals. For example, estimated capacity for Lambert's Point (Hampton Roads, Virginia) is 38 MMst in Table 1 and 48 MMst in Table 2. Estimated capacities can differ based on judgements about effective maximum capacity. Given sufficient market demand and economic incentives to handle coal, a terminal will typically seek to maximize throughput and operate at (or at least near) effective maximum capacity. But achievable throughput may in practice be limited by a variety of logistical and other constraints, and some sources estimate lower capacities for specific terminals based on judgments regarding achievable throughput.

[34] See endnote 32 for additional sources providing estimates of US Coal Exports and Terminal Capacity.

[35] See Sections 7.5.2, 7.7, and 9.4.2.2 (including Figure 20).

[36] Advancing U.S. Coal Exports: Draft, National Coal Council, 2018 (endnote 31), p. 37. http://www.nationalcoalcouncil.org/studies/2018/NCC-US-Coal-Exports-2018.pdf

> The Los Angeles area was once host to a 10 million ton transloading facility (referred to as the LAX Terminal or LAXT). LAXT was decommissioned in 2001 when the expected throughput volume did not materialize.

https://www.coalage.com/features/building-a-coal-terminal-on-the-west-coast/

> Two modern coal terminals were built on the West Coast in the last two decades of the twentieth century. One at the Port of Portland was built and failed within the 1980s, leaving barely-used equipment that had to be sold. Participants in the LAXT consortium were aware of that failure, but went ahead and built one of the finest coal terminals in North America, the only U.S. terminal capable of loading a 275,000-dwt vessel. Coal giant Peabody Energy dropped out of the consortium before the terminal was built, but other participants forged ahead and built it. It was commissioned December 4, 1997, and it stopped shipping coal in 2003.

https://www.upi.com/Archives/1982/02/09/Reidel-International-of-Portland-has-been-selected-to-build/7628382078800/

[37] https://www.teck.com/media/Deutsche-Bank-Leveraged-Finance-Conference.pdf

https://www.ramcoal.com/assets/docs/ppt/Coal-mining-booklet-final.pdf

[38] The existing US West Coast coal export terminals are in California (see Table 1 and Table 2), and they also export petroleum coke (also referred to as petcoke). Exports of petroleum coke are relatively stable. California oil refineries produce sizable volumes of petroleum coke, a byproduct that must be disposed of, typically via export to overseas markets.

https://www.up.com/customers/energy/ports-docks/index.htm

http://www.bcdc.ca.gov/planning/reports/bulk_cargo_forecast.pdf especially pp. 13-15

https://www.portofstockton.com/facilitiesservices

https://www.oxbow.com/Services_Terminals_Long_Beach.html

[39] Capacity for US coal exports via existing Pacific Coast terminals has been more fully utilized for limited periods. See Section 7.7.3 regarding Westshore (the largest West Coast coal export terminal) as a port alternative for thermal coal exports. Westshore operated at full capacity around 2011-12, during a boom period for seaborne metallurgical and thermal coal markets. Coal markets then shifted from boom to bust; Westshore completed a capacity expansion; and capacity for exports of US thermal coal was not being fully utilized. More recently, coal markets have been stronger, and capacity at Westshore is being more fully utilized. Westshore mainly handles metallurgical coal, with relatively stable volumes. Hence, even in periods of weak coal markets, capacity utilization has exceeded 75%.

Capacity utilization has been more variable at US West Coast terminals, which are located in California, and which handle thermal coal, with occasional typically small volumes of metallurgical coal, as well petroleum coke (see endnote 31). Exports of thermal coal at San Francisco area terminals were minimal before 2013 and have since varied based on market conditions (1-3 MMTPY). Likewise, exports of thermal coal at Los Angeles area terminals were minimal before 2010 and have since varied based on market conditions (0.6-1.6 MMTPY).

EIA, Coal Data Browser

https://www.eia.gov/coal/data/browser/#/topic/41?agg=2,1,0&rank=ok&cntry=vvvvvvvvvvvvvvvvvvvvvvvvvvvto&cust=000000040&linechart=COAL.EXPORT_QTY.TOT-TOT-SF_CA.A~COAL.EXPORT_QTY.STM-TOT-SF_CA.A~COAL.EXPORT_QTY.MET-TOT-SF_CA.A&columnchart=COAL.EXPORT_QTY.TOT-TOT-SF_CA.A&map=COAL.EXPORT_QTY.MET-TOT-LA_CA.A&freq=A&start=2007&end=2017&ctype=linechart&ltype=pin&rtype=s&mntp=g&geo=000000000008&maptype=0&rse=0&pin=

https://www.eia.gov/coal/data/browser/#/topic/41?agg=2,1,0&rank=ok&cntry=vvvvvvvvvvvvvvvvvvvvvvvvvvto&cust=000200000&linechart=COAL.EXPORT_QTY.TOT-TOT-LA_CA.A~COAL.EXPORT_QTY.STM-TOT-LA_CA.A~COAL.EXPORT_QTY.MET-TOT-LA_CA.A&columnchart=COAL.EXPORT_QTY.TOT-TOT-LA_CA.A&map=COAL.EXPORT_QTY.STM-TOT-LA_CA.A&freq=A&start=2007&end=2017&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0&geo=000000000008&mntp=g

[40] FEIS SEPA Coal Market Assessment Technical Report, p. 4-20.

[41] FEIS Vol. IV: Responses to Comments on the Draft EIS, pp. 5.8-67; http://www.millenniumbulkeiswa.gov/assets/01-volume-iv-appendix-b-introduction-and-federal-agencies22.pdf

> Sub-bituminous PRB coal is the major coal source that MBT is likely to serve. […]
>
> [T]he proposed terminal would primarily serve Powder River Basin coal producers[.]

FEIS, SEPA Coal Market Assessment Technical Report, p. 2-9:

> Given market economics, most of the coal that would be exported would be expected to come from Powder River Basin mines in Montana and Wyoming[.]

In each of the coal market scenarios modeled in the FEIS, it was estimated that Powder River Basin mines would provide all or almost all of the coal supply for the Project; Uinta Basin mines would provide no supply or only a small amount. FEIS, SEPA Greenhouse Gas Emissions Technical Report, pp. 4-2–4-6, SEPA Coal Market Assessment Technical Report, pp. 6-10–6-12, 6-24–6-27, 6-38–6-41, 6-52–6-54, 6-66–6-68.

[42] FEIS SEPA Coal Market Assessment Technical Report, p. 2-15.

[43] FEIS SEPA Coal Market Assessment Technical Report, p. 2-2.

[44] EIA Coal Data Browser

https://www.eia.gov/coal/data/browser/#/topic/33?agg=0,2,1&rank=g&geo=g00000000000000c&mntp=g&linechart=COAL.PRODUCTION.TOT-US-TOT.A~COAL.PRODUCTION.TOT-PRB-TOT.A~COAL.PRODUCTION.TOT-UNT-TOT.A&columnchart=COAL.PRODUCTION.TOT-US-TOT.A&map=COAL.PRODUCTION.TOT-US-TOT.A&freq=A&start=2001&end=2017&ctype=linechart&ltype=sourcekey&rtype=b&maptype=0&rse=0&pin=

[45] This endnote provides sources for the entire paragraph. FEIS, SEPA Coal Market Assessment Technical Report, p. 2-5, 2-17, and especially 2-4 (bold in original):

> This analysis considers the following three sources of Powder River Basin coal.
>
> **Montana coal**: Coal produced in Montana with a heat content of 9,300 British thermal units per pound (Btu/lb).
>
> **Wyoming 8400 coal**: Coal produced in Wyoming with a heat content of 8,400 Btu/lb.
>
> **Wyoming 8800 coal**: Coal produced in Wyoming with a heat content of 8,800 Btu/lb.
>
> Since 2008, Wyoming coalfields have produced about 91% of Powder River Basin coal, with the remaining 9% produced in Montana […]. However, because Montana coal has a higher heat content, it is more likely to be exported. Higher heat content coals are more likely to be exported because they contain more heating potential per ton of coal, thus, users have to transport fewer tons of high heat content coal than they would have to import lower heat content coal. For example, a coal consumer would have to import 5.7% more Wyoming 8,800 coal than they would the higher heat content Montana coal.

Ambre Energy, 2011 Annual Report (financial year ending 30 June 2011), p. 15: http://ambreenergy.com.au/wp-content/uploads/2015/08/annualreport2011_ae_webversion_final.pdf

> Coals such as those at Ambre Energy's […] Decker coal mine based in Montana are the best suited coals for the Asian export market. In addition to the state's geographical advantage to the US west coast, the Montana coals have higher energy levels compared to the southern PRB in Wyoming.

Cloud Peak Energy, Investor Presentation, October 2018, p. 11. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

EIA, Annual Coal Report 2016, pp. 3, 18-22; https://www.eia.gov/coal/annual/archive/05842016.pdf

EIA (endnote 23), Coal Market Module of the National Energy Modeling System: Model Documentation 2018, June 2018; and Assumptions to AEO 2018: Coal Market Module;

Powder River Basin Coal Resource and Cost Study. Report. No. 3155.001. John T. Boyd Company, September 2011 (endnote 78).

[46] Powder River Basin Coal Resource and Cost Study, Prepared for Xcel Energy, September 2011, Exhibit 1 (see Section 5.5.4 and endnote 78 regarding this study). The map in Figure 5 appears in a study dated September 2011. This is just prior to when

Lighthouse (then known as Ambre Energy North America) first became a US coal producer in November 2011. Ownership of mines was the same in 2016, except that in the interim, Decker Mine was acquired by Lighthouse, and the mines that had been owned by Alpha Natural Resources were acquired by Contura Energy (which were then acquired by Blackjewel in 2017). See Sections 4.8 and 5.6 regarding Lighthouse acquisition of Decker Mine.

[47] Luppens, J.A., et al, Coal Geology and Assessment of Coal Resources and Reserves in the Powder River Basin, Wyoming and Montana, USGS Professional Paper 1809, 2015, Figure 13, p. 64 https://pubs.usgs.gov/pp/1809/; http://dx.doi.org/10.3133/pp1809 (The original map from source shows "Coal Creek Mine (abandoned)" which is an apparent typo; as shown elsewhere in this and other sources, Coal Creek Mine continues to operate and produce coal. The map shown herein (Figure 6) has been edited to correct this typo.)

[48] https://www.eia.gov/energyexplained/index.php?page=coal_where

[49] EIA, Coal Data Browser https://www.eia.gov/coal/data/browser/#/topic/33?agg=0,2,1&rank=g&geo=vvvvvvvvvvvvo&mntp=g&linechart=COAL.PRODUCTION.TOT-US-TOT.A~COAL.PRODUCTION.TOT-WY-TOT.A~COAL.PRODUCTION.TOT-MT-TOT.A&columnchart=COAL.PRODUCTION.TOT-US-TOT.A&map=COAL.PRODUCTION.TOT-US-TOT.A&freq=A&start=2001&end=2017&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=

[50] Analysis Group, The U.S. Coal Industry: Challenging Transitions in the 21st Century, September 26, 2016, p. 12. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/tierney%20-%20coal%20industry%20-%2021st%20century%20challenges%209-26-2016.pdf

[51] [footnote 27 in original] EIA, Annual Coal Report, 2015.

[52] The U.S. Coal Industry: Historical Trends and Recent Developments, Congressional Research Service, Report R44922, August 18, 2017, pp. 12-13 (bold in original, underlining added for emphasis). https://www.everycrsreport.com/files/20170818_R44922_d2fde6a9ab22ed951d390af83d4d95ffc216d707.pdf; similar content is provided in 21st Century U.S. Energy Sources: A Primer, Congressional Research Service, Report R44854, May 19, 2017, pp. 23-24 https://fas.org/sgp/crs/misc/R44854.pdf and https://www.hsdl.org/?view&did=801208

[53] Table 5 from the Congressional Research Service report**.**

[54] Section 6 provides additional information regarding coal producers (notably those with production in the Powder River Basin and nexus to potential exports via Millennium).

[55] During main preparation of this report, the most recently available listing was from EIA, Annual Coal Report 2016. Annual Coal Report 2017 was released in early November 2018, and it was not possible to comprehensively update this report to incorporate this new information prior to the November 14, 2018 filing date. See endnotes 56-64 for information based on Annual Coal Report 2017 that could be provided to update this report.

[56] EIA, Annual Coal Report 2016, Table 10 (highlighting added for emphasis): 8 major coal producers with mines in Wyoming and Montana (notably Powder River Basin), ranked #1-3, 5, 8, 13, 17, 21.
https://www.eia.gov/coal/annual/archive/05842016.pdf

See also endnote 55 and EIA, Annual Coal Report 2017, Table 10
https://www.eia.gov/coal/annual/pdf/acr.pdf

In 2017, there were 23 major producers, comprising 88% of overall US coal production. **Lighthouse does not make this list.** There are 8 major coal producers with mines in Wyoming and Montana (notably Powder River Basin), ranked #1-3, 6, 9, 12, 21-22. These producers comprise about half (53%) of overall US production.

[57] This endnote provides information for the entire paragraph. See endnotes 55, 56, and Table 3.

2016: Lighthouse production = 4.28 MMst = 3.20 MMst (Decker Mine 100% ownership) + 1.08 MMst (Black Butte Mine 50% ownership). Lighthouse production as % of overall US production = .059% = 4.28 MMst/728.36 MMst.

2017: Lighthouse production = 5.44 MMst = 4.16 MMst (Decker Mine 100% ownership) + 1.28 MMst (Black Butte Mine 50% ownership). Lighthouse production as % of overall US production = .070% = 5.44 MMst/774.61 MMst.

[58] See endnote 56 for 2017 information.

[59] Figure 5 is as of September 2011. See endnote 46 regarding subsequent changes in ownership of mines.

[60] This endnote provides information for the entire paragraph. See endnote 61 for 2017 information.

[61] See endnotes 55, 64, and Table 4.

2016: 16 major mines in Wyoming and Montana production = 320.5 MMst = 291.7 MMst (12 major mines in Wyoming) + 28.8 MMst (4 major mines in Montana). Overall Wyoming and Montana production = 329.5 MMst = 297.2 MMst (Wyoming) + 32.3 MMst (Montana). 16 major mines production as % of overall production in Wyoming and Montana = 97.3% = 320.5 MMst/329.5 MMst. The only context where Lighthouse might be considered to be a significant portion of overall coal production is in Montana, where the Lighthouse Decker Mine comprised about 10% of overall Montana coal production in 2016. But Montana's coal production is relatively small: only about 4% of total US and about 10 times smaller than Wyoming's. Hence, the Decker Mine provides only about 0.4% of total US production.

2017: 47 major mines in US production as % of overall production in US = 71.9% = 557.2 MMst/774.6 MMst. 16 major mines in Wyoming and Montana production = 340.9 MMst = 309.5 MMst (12 major mines in Wyoming) + 31.4 MMst (4 major mines in Montana). Overall Wyoming and Montana production = 351.7 MMst = 316.5 MMst (Wyoming) + 35.2 MMst (Montana). 16 major mines production as % of overall production in Wyoming and Montana = 96.9% = 340.9 MMst/351.7 MMst. 16 major mines production as % of overall production in US = 44.0% = 340.9 MMst/774.6 MMst.

Major mines in 2017 include Lighthouse Decker Mine, with 4.2 MMst production (just above 4 MMst, the EIA criterion for major mines). In 2017, Decker is ranked #47 of 47 (at the very bottom of the EIA listing of major mines). As explained in Section 5.5.2 and shown in Figure 9, Decker production is variable year-to-year and has been substantially below 4 MMst in all recent years except 2017. Hence, the inclusion of the Decker Mine at the bottom of the EIA listing of major mines in 2017 should not be taken as clear indicator of future production at Decker.

The only context where Lighthouse might be considered to be a significant portion of overall coal production is in Montana, where the Lighthouse Decker Mine comprised about 12% of overall Montana coal production in 2017. But Montana's coal production is relatively small: only about 4% of total US and about 10 times smaller than Wyoming's. Hence, the Decker Mine provides only about 0.5% of total US production.

[62] Figure 5 is as of September 2011. See endnote 46 regarding subsequent changes in ownership of mines.

[63] See FEIS SEPA Coal Market Assessment Technical Report, p. 2-5 and endnote 83.

[64] EIA, Annual Coal Report 2016, Table 9 (highlighting added for emphasis): 16 major mines in Wyoming and Montana (notably Powder River Basin), ranked #1-6, 10, 12, 15, 17-18, 21, 27, 29, 41, 44.
https://www.eia.gov/coal/annual/archive/05842016.pdf
See also endnotes 55 and 61**Error! Bookmark not defined.**, and EIA, Annual Coal R eport 2017, Table 9. 16 major mines in Wyoming and Montana (notably Powder River Basin), ranked #1-6, 10, 12, 15, 17-18, 21, 27, 29, 41, 44.

https://www.eia.gov/coal/annual/pdf/acr.pdf

[65] This endnote provides sources for the entire paragraph. Complaint in federal litigation (¶¶16-20); FEIS p. 2-2; http://www.lighthouseresourcesinc.com/#about

http://www.lighthouseresourcesinc.com/decker-mine/

http://www.lighthouseresourcesinc.com/black-butte-mine/

66

http://www.wyogeo.org/contents/plugins/innovaeditor/assets/Chris%20Carroll%20State%20of%20the%20Coal%20Industry%20in%20Wyoming%20-%20August%202014.pdf

67 http://www.resourcecapitalfunds.com

http://www.resourcecapitalfunds.com/current-portfolio

http://www.resourcecapitalfunds.com/lighthouse-resources-plans-to-supply-cleaner-coal-to-asian-market

> Lighthouse Resources was previously known as Ambre Energy North America before the company announced in April 2015 that it would change its name to reflect the company's core business strategy to focus on resource management and infrastructure projects. Resource Capital Funds through RCF V initially financed what was then Ambre Energy North America's purchase of the Decker and Black Butte mines in 2011.
>
> Since its original investment in 2011, RCF has made a number of additional investments in the Company. In late 2014, RCF purchased the North American assets of Ambre from its Australian Parent and it now holds a 92% interest in these assets with 8% being held by the shareholders of the Australian entity.

68 RCF investment funds (RCF V and RCF VI) with specific ownership of Lighthouse (previously known as Ambre Energy North America) are registered in the Cayman Islands and claim the following exemptions from SEC requirements: Rule 506 and Investment Company Act Section 3(c)(7). See endnotes 67 and 123, and

https://www.sec.gov/Archives/edgar/data/1465397/000101297509000167/xslFormDX01/primary_doc.xml

https://www.sec.gov/Archives/edgar/data/1465397/000101297510000091/xslFormDX01/primary_doc.xml

https://www.sec.gov/Archives/edgar/data/1569972/000156997213000001/xslFormDX01/primary_doc.xml

69 See endnote 123.

70 Complaint ¶¶37-44 (underlining added for emphasis).

71 See Sections 5.5.4 and 5.5.5 and John T. Boyd Powder River Basin 2011 and 2017 Studies providing additional data and analysis regarding Decker Mine; as noted in Boyd 2011 Study (endnote 78, p. 4-8) and 2017 Study (endnote 83), Decker Mine production was 13 MMst in the late 1970s and 11.9 MMst in 1997.

72 EIA, Coal Data Browser
https://www.eia.gov/coal/data/browser/#/mine/2400839?freq=A&start=2001&end=2017&ctype=linechart&ltype=pin&columnchart=COAL.MINE.PRODUCTION.2400839-SUB-SUR.A&linechart=COAL.MINE.PRODUCTION.2400839-SUB-SUR.A&maptype=0&pin

73 Data shown is for a 50% ownership share (which Lighthouse acquired from Level 3 Communications in 2011, see Section 5.6.2), so is 50% of total Black Butte production (including both sub-bituminous coal (all reported output for 2001-2013) and bituminous coal (all reported output for 2014-2017)). EIA, Coal Data Browser,
https://www.eia.gov/coal/data/browser/#/mine/4801180?freq=A&start=2001&end=2017&ctype=linechart&ltype=pin&maptype=0&linechart=COAL.MINE.PRODUCTION.4801180-BIT-SUR.A~COAL.MINE.PRODUCTION.4801180-SUB-SUR.A&columnchart=COAL.MINE.PRODUCTION.4801180-BIT-SUR.A&pin=

74 See especially Sections 5.5.3, 5.5.4, 5.5.5, 5.6.2, and 5.6.3.

75 See especially Sections 5.5.4, 5.5.5, 5.6.2, and 5.6.3.

76 Level 3 Communications, Inc., 2010 Annual Report, Form 10-K, p. 25 (underlining added for emphasis)
https://www.sec.gov/Archives/edgar/data/794323/000104746911001410/a2202016z10-k.htm

77 See endnote 78 for information on John T. Boyd.

78 Powder River Basin Coal Resource and Cost Study: Campbell, Converse and Sheridan Counties, Wyoming; Big Horn, Powder River, Rosebud and Treasure Counties, Montana, John T. Boyd, Company, Prepared for Xcel Energy, Report No. 3155.001, September 2011
https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/PSCo-ERP-2011/8-Roberts-Exhibit-No-MWR-1.pdf also available at

https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BEC9AC071-1541-43D3-A57A-418AA72EC7FF%7D&documentTitle=20126-75412-01 see especially pdf p. 2.

John T. Boyd is a leading mining and geological consultancy providing expert reports, testimony, and other advisory services to a diverse clientele including domestic and international mining companies, investors, financial institutions, electricity generators and other coal consumers, governmental agencies, and attorneys.
http://www.jtboyd.com/

Boyd's services have included expert review of Powder River Basin coal resources and reserves assessments on behalf of Cloud Peak Energy.
Cloud Peak Energy, November 28, 2009 Prospectus, pp. 35, 159-160, 235
http://www.sec.gov/Archives/edgar/data/1441849/000104746909010369/a2195588z424b4.htm

[79] This endnote provides sources for the entire paragraph. Xcel Energy provides electric service in eight Western and Midwestern states (Colorado, Michigan, Minnesota, New Mexico, North Dakota, South Dakota, Texas, and Wisconsin).

https://www.xcelenergy.com

https://www.xcelenergy.com/energy_portfolio/electricity/power_generation

https://www.xcelenergy.com/company/corporate_responsibility_report/who_we_are

https://www.xcelenergy.com/company/corporate_responsibility_report/2017_highlights

[80] Studies and other coal industry information sources are sometimes proprietary, with access restricted to subscribers or even more limited; see e.g., endnote 83 and https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BEC9AC071-1541-43D3-A57A-418AA72EC7FF%7D&documentTitle=20126-75412-01 (pdf p. 2)

[81] EIA, Assumptions to AEO 2018: Coal Market Module, pp. 2, 14 https://www.eia.gov/outlooks/aeo/assumptions/pdf/coal.pdf

[82] As explained in Section 6.3.2.4, permitting of the Tongue River Railroad included preparation of a federal EIS. The analysis of coal production and markets in the DEIS relied extensively upon the Boyd 2011 Study; the project was halted prior to issuance of an FEIS. Tongue River Railroad DEIS, April 2015, Appendix C https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

[83] John T. Boyd Company, "Changing Currents" - How the Powder River Basin's Balance of Supply Will Evolve Over the Next 20 Years, August 2017. http://www.jtboyd.com/powder-river-basin-coal.php The study is proprietary, but results are summarized in a publicly available webcast: https://www.youtube.com/watch?v=p-RNzpsg8v0&feature=youtu.be

[84] As will be explained in Sections 5.6.2 and 5.6.3, Ambre/Lighthouse acquired 50% of the Decker Mine from Level 3 Communications in 2011 and the other 50% from Cloud Peak Energy in 2014.

[85] Boyd 2011 Study (endnote 78), pp. 4-8–4-9 (underlining added for emphasis).

[86] Boyd 2011 Study (endnote 78), p. 5-9 (underlining added for emphasis). See also Table 4.1: “Available resources are nearly depleted.”

[87] Boyd 2011 Study (endnote 78), pp. 4-29. The Rosebud Mine also has higher strip ratios and higher production costs than other PRB mines, but this is offset by low transportation costs; nearly all Rosebud production goes to the adjacent Colstrip power

plant. See endnote 97 for additional information and analysis in regard to the Black Butte Mine supplying coal to the nearby Jim Bridger power plan.

[88] This endnote provides sources for the entire paragraph. Boyd 2011 Study (endnote 78), pp. 2-1—2-2 (test box added for emphasis):

> In this study we have addressed PRB coal resources from the standpoint of the available supply of coal for use as fuel for electrical generation – coal which would be considered a “Resource”, but not necessarily a “Reserve”. For purposes of this report “viable resources” are defined as the recoverable coal tonnage that is or could reasonably be expected to become technically and legally mineable, and which is economic today or could reasonably be expected to become economic within the 30-year timeframe of this study.
>
> […] Our assessment of the viable resources available to these mines focuses on three categories:

- Permitted Resources. Includes resources that are permitted and/or reported in financial filings. These resources are typically well explored, permitted for mining, and committed to a specific mine plan.
- LBA Resources. Includes resources that are controlled but are not permitted or reported in financial filings, and resources on identified tracts that have been applied for via the LBA process and are considered likely to be leased.
- Future Resources. Includes resources on lands that are within a particular mine’s area of interest, are accessible from the existing operation, and which could logically be incorporated into future plans for the mine. […]

Mine	Coal Resources (Millions of Tons) Permitted	LBAs	Future	Total
Antelope	252.0	406.6	479.0	1,137.6
North Antelope/Rochelle	723.0	1,179.0	1,535.0	3,437.0
School Creek	762.0	0.0	279.0	1,041.0
Black Thunder	1,256.4	1,988.4	1,944.6	5,189.4
Coal Creek	198.0	56.0	224.0	478.0
Cordero Rojo	190.1	776.7	701.5	1,668.3
Belle Ayr	155.0	0.0	745.0	900.0
Caballo	235.2	221.7	598.0	1,054.9
Wyodak	261.9	0.0	0.0	261.9
Dry Fork	110.9	0.0	0.0	110.9
Eagle Butte	425.0	0.0	398.0	823.0
Rawhide	329.7	0.0	1,448.0	1,777.7
Buckskin	280.7	52.0	1,202.0	1,534.7
Decker	12.0	0.0	0.0	12.0
Spring Creek	329.0	0.0	271.0	600.0
Absaloka	49.8	0.0	130.2	180.0
Rosebud	202.0	0.0	158.0	360.0
Totals	5,772.7	4,680.4	10,113.3	20,566.4

Coal Resource estimates are as of December 31, 2010.

89 Tongue River Railroad DEIS, April 2015, p. C.6-32 (see also endnote 82)
https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

Decker is likely to close in the near future and, thus, its productivity values may be skewed.

90 See e.g., Cloud Peak Energy Inc., 2017 Annual Report, Form 10-K, pp. iii, vii, viii, 12-13, 25.
https://www.sec.gov/Archives/edgar/data/1441849/000110465918010090/a18-1077_110k.htm

91 See e.g., McKinsey & Company, Downsizing the US coal industry: Can a slow-motion train wreck be avoided?, November 2015, pp. 10-11
http://www.mckinsey.com/~/media/McKinsey/Industries/Metals and Mining/Our Insights/Downsizing the US coal industry/Downsizing the US%20coal industry.ashx

> it costs much more in the short term to shut a mine than it does to keep running it, even if every ton produced is unprofitable. […] The result is that the United States is home to a collection of "zombie mines" that cannot turn a profit but are too costly to close.

It should also be understood that short-term and long-term results based on financial accounting may diverge substantially. In financial accounting by US coal producers, earnings are based on revenues and costs currently recognized; asset retirement liabilities (notably for mine reclamation) are typically treated as balance sheet liabilities, and thus do not affect current earnings.

But in the short-term, it typically costs more to close a mine than to continue operations, because closure accelerates requirements for reclamation (and associated expenditures), which could be deferred it the mine continues to operate. Hence, continuing to operate a mine (even if unprofitable) may result in lower costs short-term, but even higher costs long-term (notably for eventual reclamation).

The issues described above are specifically and substantially relevant for the Decker Mine. As explained by Cloud Peak in relation to Decker (endnote 110, ¶19):

> In 2011, Decker Mine represented a net loss of $21.1 million (100% equity interest basis) […]. The 2011 loss excludes all final reclamation costs incurred as that is charged to the balance sheet liability. The approved 2012 budget projects a full year operating loss of $11.9 million (100% interest) which assumes final reclamation costs incurred of $13.2 million are charged to the balance sheet liability.

As illustrated by Decker, a mine is unprofitable to operate based on current earnings will be even more unprofitable long-term, because ongoing mine operations result in increased reclamation liabilities (increased requirements for future expenditures to undertake reclamation). And these reclamation liabilities can be quite sizable relative to current year financial accounting losses. As explained by Cloud Peak, budgeted 2012 operations at Decker were estimated to result in an incremental $13.2 million reclamation liability (charged to the balance sheet liability), as well as a full year operating loss of $11.9 million.

92 *Western Minerals LLC v. KCP, Inc.; Ambre Energy North America, Inc.; and Ambre Energy Ltd.*, US District Court, District of Montana Billings Division, Case No. CV-12-85-BLG-RFC-CSO, Answer, Counterclaim and Third-Party Complaint, July 30, 2012, p. 43, ¶22.

http://publish.generationhub.com/document/2012/08/01/Ambre%20Response%20Filing.pdf

[93] See endnote 83. Litigation by WildEarth Guardians claims that Powder River mines (including both Decker and Spring Creek) are failing to meet requirements for contemporaneous reclamation. https://climatewest.files.wordpress.com/2018/04/2018-4-2-prb-coal-mines-contemporaneous-reclamation-complaint.pdf See also

https://www.powderriverbasin.org/wp-content/uploads/2018/07/Coal-Mine-Reclamation-Web-Final.pdf

[94] BDO Corporate Finance (QLD) Ltd., Ambre Energy Limited: Independent Expert's Report, November 7, 2013, especially pp. vi-2 (Financial Services Guide and Introduction) and pp. 97-104 (Appendix F-Valuation of the Black Butte Mine). http://www.documentcloud.org/documents/1020835-ambre-report.html#document/p84/a145986 (pdf pp. 44-184 (BDO report)).

BDO is a global accounting firm; BDO Corporate Finance (QLD) Ltd. holds an Australian Financial Services License to provide financial product advice and deal in financial products. https://www.bdo.com.au/en-au/services/advisory/corporate-finance

[95] BDO, Independent Expert's Report (endnote 94), p. 98 (pdf p. 152) (underlining added for emphasis). As defined in the BDO Valuation, Port Assets include both the Millennium Project and the Morrow Project in Oregon (see Section 9.4.2.1).

[96] See Sections 5.5.2 and 5.5.3.

[97] This endnote provides sources for the entire paragraph.

Coal mines which are proximate to customers (notably adjacent or near to power plants) can have higher production costs and still be competitive owing to lower transport costs.

As explained in the Boyd 2011 Study (endnote 78, p. 4-6), the Rosebud Mine in the Powder River Basin has higher stripping ratios and higher production costs than other PRB mine; Rosebud is not typically competitive to sell coal onto the open market, but is competitive to supply nearly all of its output to the adjacent Colstrip power plant:

> The Rosebud Mine currently has higher strip ratio than other mines in the PRB and associated higher production cost. The mine is adjacent to the power plant therefore the delivered cost of coal is generally less than if coal was purchased and delivered by railroad from other PRB mines. Although the mine has sold coal on the open market previously, it is not likely to be a significant influence on markets and prices since nearly all of the coal goes to the Colstrip power plant.

Hence, the Boyd 2011 Study (endnote 78, p. 5-9) forecasts that the Rosebud Mine will continue to operate because it is supplying a proximate power plant and is generally independent from the non-proximate coal market:

> […] the forecast assumes certain higher cost mines will maintain current production levels for specific reasons, including:
>
> - Rosebud Mine – is more or less captive to the Colstrip power plant and generally independent from the PRB coal market.

Like the Rosebud Mine in the Montana Powder River Basin, the Black Butte Mine (in southwest Wyoming) has production costs that are higher than at competing mines, but it has had an ongoing market supplying a nearby power plant. Black Butte has now lost all of its non-proximate customers and its entire production goes to the Jim Bridger power plant.

Reply Testimony of Seth Schwartz (Redacted), on behalf of PacifiCorp, July 2017, Public Utility Commission of Oregon, Docket No. UE 323, Exhibit PAC/700, pp. 14-16 (underlining added for emphasis)
https://edocs.puc.state.or.us/efdocs/HTB/ue323htb165546.pdf

> The Jim Bridger plant was originally developed with a captive coal supply from the adjacent Jim Bridger surface mine (delivered by conveyor) for all of the plant requirements. Over time, the cost of coal from the surface mine increased due to depletion and PacifiCorp developed the Bridger underground mine and purchased outside coal from the nearby Black Butte coal mine. PacifiCorp installed a limited ability to deliver coal by rail to deliver the Black Butte coal and has considered the purchase of coal by rail from the PRB. There is a substantial investment in the plant and the unloading facilities, with a long lead time required for the plant to use significant quantities of PRB coal.
>
> […]
>
> <u>In 2016, the Black Butte mine produced 2.16 million tons of coal, 100 percent of which was purchased by the owners of the Jim Bridger plant</u>. Due to changes in the coal market, <u>Black Butte has lost all of its other customers and the Jim Bridger plant is its sole remaining market. Before 2016, Black Butte had produced between 2.7 and 4.0 million tons per year</u>.

Similar information is provided in PacifiCorp Confidential Long-Term Fuel Supply Plan For The Jim Bridger Plant (Redacted), March 2018, Public Utility Commission of Oregon, UE 323 – PacifiCorp's Compliance Filing, especially p. 10: https://www.pacificpower.net/content/dam/pacific_power/doc/About_Us/Rates_Regulation/Oregon/Regulatory_Filings/Docket_UE_323/3-30-18_Compliance_Filing/filing/UE_323_PacifiCorp_Compliance_Filing_Long-Term_Fuel_Supply_Plan_for_JB_Plant_REDACTED.pdf

> The Black Butte mine, 20 miles southeast of the Jim Bridger plant, is jointly owned by Lighthouse Resources Inc. (Lighthouse) and Anadarko Petroleum. […] Historically, Black Butte mine has mined approximately 3.5 to 4.0 million tons per year, a significant portion of which has supplied the Jim Bridger plant. However, one of Black Butte mine's significant contracts has expired […] and the Jim Bridger plant is the mine's only customer. […] During 2016 and 2017, the Jim Bridger plant received approximately one-third of its fuel supplies from the Black Butte mine […] Coal from the Black Butte mine is delivered by rail to the Jim Bridger plant under an agreement with the Union Pacific Railroad.

[98] This endnote provides sources for the entire paragraph. See endnote 97.

[99] This endnote provides sources for the entire paragraph. See Section 5.6.2 and specifically endnote 101.

[100] BDO, Independent Expert's Report (endnote 94), Appendix G Valuation of the Rosebud and Big Horn Deposits (p. 105 (pdf p. 159)); see also Table 6.2 Valuation Summary (p. 26 (pdf p. 80)) assigning a zero value to Rosebud and Big Horn deposits.

[101] This endnote provides sources for the entire paragraph.

This acquisition also included remaining coal reserves at Big Horn and Rosebud, two former coal mines in Wyoming, where reclamation has now been completed. These mines, as well Decker and Black Butte, had previously been part of Kiewit Mining Group.

Ambre Energy Limited, 2011 Annual Report, especially pp. 8-9: http://ambreenergy.com.au/wp-content/uploads/2015/08/annualreport2011_ae_webversion_final.pdf

> In November 2011, Ambre Energy acquired a 50% ownership stake in the Decker Coal Company in southern Montana, US, and Black Butte Coal Company in Wyoming, US, by purchasing KCP, Inc. from Level 3 Communications, a telecommunications and internet service provider headquartered in Broomfield, Colorado.

> The KCP purchase gives Ambre Energy the operating and marketing responsibilities for these mines. As part of the transaction, Ambre Energy also acquired a 100% interest in the remaining reserves of the Big Horn Coal Company and the Rosebud Coal Sales Company.
>
> The acquisition of KCP, Inc. was partly financed through an equity investment in Ambre Energy by Resource Capital Funds (RCF), a mining focused private equity firm […] We warmly welcome RCF as Ambre's second largest shareholder.

Kiewet Corporation website, including Kiewet Mining Group:

https://www.kiewit.com/about-us/history/1960s-and-1970s/

https://www.kiewit.com/districts/kiewit-mining-group/history/

> Reclamation has been completed at Big Horn and Rosebud.

https://www.kiewit.com/districts/kiewit-mining-group/reclamation/

102 See endnote 123.

103 Direct compensation US$4.79 million = A$4.881 = A$4.341 million (provisional consideration) + A$0.54 million (US$0.55 million working capital adjustment). Ambre Energy Limited 2012 Annual Report, pp. 43-44. http://ambreenergy.com.au/wp-content/uploads/2015/08/ambre_energy_limited_annual_report_30_june_2012_lr.pdf

104 Level 3 Communications, Inc., 2011 Annual Report, Form 10-K, p. F-23: https://www.sec.gov/Archives/edgar/data/794323/000079432312000003/lvlt-123111_10k.htm

> At December 31, 2010, the excluded reclamation liability of the discontinued operations of the coal mining business was $105 million.

105 Level 3 Communications, 2011 Form 10-K (endnote 104), pp. 59-60, 63, 76.

106 This endnote provides sources for the entire paragraph. See Section 5.5 (including Figure 9) and Section 5.6.3.4; Level 3 Communications, Inc., Annual Reports, Form 10-K, 2001 through 2011 https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0000794323&type=10-k&dateb=20130101&owner=exclude&count=100 (see also endnote 92).

107 See *Western Minerals LLC v. KCP, Inc.; Ambre Energy North America, Inc.; and Ambre Energy Ltd.*, US District Court, District of Montana Billings Division, Case No. CV-12-85-BLG-RFC-CSO, Complaint and Jury Demand, July 8, 2012, especially ¶¶18, 67-70 http://media.oregonlive.com/environment_impact/other/CloudPeakSuit.pdf;

Cloud Peak Energy, November 28, 2009 Prospectus, p 158
http://www.sec.gov/Archives/edgar/data/1441849/000104746909010369/a2195588z424b4.htm

108 This endnote provides source and notes for all of Section 5.6.3.2.

Gain on sale of Decker Mine interest in 2014 (pretax $000) = $74,262 = $72,175 (mine reclamation liability released) - $2.913 (Net Other Assets, Liabilities, Write-offs, and Other) + $5,000 (Millennium Throughput Option as valued in 2014). Hence, Gain on sale of Decker Mine interest, net of Millennium Throughput Option = $69,262 = $72,175 (mine reclamation liability released) - $2.913 (Net Other Assets, Liabilities, Write-offs, and Other). The Total Value of Millennium Throughput Option ($5,000 ($5 million)) was written-off (impaired to zero) in 2015 (see Section 5.6.3.3 and endnote 109).

Cloud Peak Energy Inc., 2014 Annual Report, Form 10-K, especially p. 84 (and quotation below) and pp. 85, 95, 101; see also pp. 1-2, 4, 48-53, 56-57, 61, 73, 76-78, 96, 106-107, 110-111, 113, 115
https://www.sec.gov/Archives/edgar/data/1441849/000110465915011392/a15-1789_110k.htm

> On September 12, 2014, we completed the sale of our 50% non-operating interest in the Decker Mine to Ambre Energy. Under the terms of the agreement, Ambre Energy acquired our 50% interest in the Decker Mine and related assets and assumed all reclamation and other liabilities, giving Ambre Energy 100% ownership of the Decker Mine. Ambre Energy also fully replaced our $66.7 million in outstanding reclamation and lease bonds relating to our 50% interest in the Decker Mine's reclamation and lease liabilities. As we no longer have any ownership interest and all of the Decker Mine liabilities have been assumed by Ambre Energy, Ambre Energy is now fully responsible for reclamation at the end of the Decker Mine's life. As a result, we released the related $72.2 million of asset retirement obligation.

Cloud Peak Energy Inc., 2013 Annual Report, Form 10-K, especially p. 15 (and quotation below):
https://www.sec.gov/Archives/edgar/data/1441849/000110465914009852/a13-27225_110k.htm

> Federal and state laws require a mine operator to secure the performance of its reclamation obligations required under SMCRA through the use of surety bonds or other approved forms of security to cover the costs the state would incur if the mine operator were unable to fulfill its obligations. As of December 31, 2013, there were approximately $677.5 million in surety bonds outstanding to

> secure the performance of our reclamation obligations (including $66.8 million with respect to our obligations for the Decker mine […].

Cloud Peak Energy and Ambre Energy, Press Release: "Cloud Peak Energy and Ambre Energy Announce Signing of Deal for Ambre Energy's Purchase of Decker Mine Interest from Cloud Peak Energy," September 4, 2014: https://investor.cloudpeakenergy.com/press-release/business-development/cloud-peak-energy-and-ambre-energy-announce-signing-deal-ambre-en

- Purchase by Ambre Energy of Cloud Peak Energy's 50% interest in Decker and related assets, to assume 100% ownership of Decker Mine.
- Assumption by Ambre Energy of all reclamation and other Decker liabilities and replacement of Cloud Peak Energy's $66.7 million in outstanding reclamation and lease bonds.
- Option granted to Cloud Peak Energy for up to 7 million metric tonnes per year of throughput capacity at Ambre's majority-owned proposed Millennium Bulk Terminals facility in the U.S. Pacific Northwest.

BDO, Independent Expert's Report (endnote 94), p. 92 (underlining added for emphasis):

> <u>The cash cost to complete the purchase of CPE's 50% interest in the Decker mine is assumed to be nil</u>. As consideration for CPE's 50% interest […], AEL will provide CPE with […] an option to acquire throughput capacity at MBTL.

[109] This endnote provides source and notes for all of Section 5.6.3.3.

Cloud Peak Energy Inc., 2014 Annual Report, Form 10-K, especially p. 7: https://www.sec.gov/Archives/edgar/data/1441849/000110465915011392/a15-1789_110k.htm

> As part of the Decker Mine divestiture transaction, we were granted a throughput option for up to 7.7 million tons per year at the proposed Millennium Bulk Terminals coal export facility in Washington State. The proposed new coal export facility is currently in the permitting stage and is planned to be developed in two phases. Our option covers up to 3.3 million tons per year of capacity during the first phase of development and an additional 4.4 million tons per year once the second phase of development is reached. Our throughput capacity will have an initial term of 10 years, with four renewal options for five-year terms.
>
> […]

> We also have a throughput option agreement with SSA Marine, which provides us with an option for up to 17.6 million tons of capacity per year through the planned dry bulk cargo Gateway Pacific Terminal at Cherry Point in Washington State. Our potential share of capacity will depend upon the ultimate capacity of the terminal and is subject to the terms of the option agreement. The terminal will accommodate cape size vessels.

Cloud Peak Energy Inc., 2015 Annual Report, Form 10-K, especially pp. 81, 93 (and quotation below)
https://www.sec.gov/Archives/edgar/data/1441849/000110465916097811/a15-23313_110k.htm

> On August 13, 2015, we announced that we and the Crow Tribe joined SSA Marine as 49% partners in GPT. Under the new ownership structure, SSA Marine remained the majority owner, retaining 51% of the equity. The Crow Tribe has an option to secure up to 5%, with a corresponding reduction in our ownership. For our 49% ownership interest, we paid $2 million upon signing and will pay all future permitting expenses up to $30 million, which we anticipate will cover such expenses through 2019. Thereafter, the owners will share any permitting expenses in excess of $30 million in proportion with their ownership interests. As of December 31, 2015, we have paid $6.6 million toward permitting expenses as a partner. [p. 81]
>
> […]
>
> In consideration of consensus projections of weak export pricing, a weak outlook for coal exports, and our associated decision to amend the port and rail contracts to require no export shipments from 2016 through 2018 in exchange for ongoing quarterly payments less than the prior take-or-pay requirements, we determined that the carrying values of certain intangible assets in our Logistics and Related Activities segment were impaired. We have written off the port access rights related to Westshore, MBT, and GPT of $33.4 million, $5.0 million, and $13.8 million, respectively, during the year ended December 31, 2015.
>
> Due to the factors described above, we have fully impaired our equity investment in GPT by recording a charge of $6.0 million during the fourth quarter of 2015. […]

Westshore Terminals

> In August 2014, we paid $37.0 million to Coal Valley Resources, Inc. (“CVRI”), a unit of Westmoreland Coal Company, to terminate its throughput agreement with Westshore. In a related transaction, we amended our existing throughput agreement with Westshore to increase our annual committed volumes from 2.8 million tons to 6.3 million tons initially and increasing to 7.2 million tons in 2019. In addition, we extended the term of our throughput agreement from the end of 2022 through the end of 2024. In August 2014, we also amended our existing transportation agreement with BNSF related to shipments from the Spring Creek Mine to Westshore to align the committed volumes with the terms of the amended Westshore agreement.
>
> We initially capitalized the $37.1 million payment as an intangible asset and began amortizing it in 2015 on a straight line basis over the term of the contract. However, as previously described in Note 9, in consideration of consensus projections of weak export pricing, a weak outlook for coal exports and our associated decision to amend the port and rail contracts to require no export shipments from 2016 through 2018 in exchange for ongoing quarterly payments less than the prior take-or-pay requirements, we determined that the carrying value of this intangible asset was impaired. We have written off the Westshore port access rights of $33.4 million during the year ended December 31, 2015. [pp. 93-94]

Lighthouse et al. v. Inslee et al., US District Court, Western District of Washington at Tacoma, Case No. 3.18-dv-05005-RJB, State Defendants’ Interrogatories and Requests for Production to Plaintiffs and Plaintiffs Objections, Answers and Responses Thereto; July 18, 2018, Interrogatory Response 3:

> Lighthouse […] may provide export capacity to third-party shippers Cloud Peak Energy and Arch Coal Inc. at the Millennium Bulk Terminal if the Project is completed. Cloud Peak Energy has an option to export up to three million metric tons of coal per year at Stage One of the Project and an additional four million metric tons of coal per year at Stage Two of the Project. Arch Coal Inc. has an option to export up to ten percent of the throughput capacity of the Project for a period of ten years, with the option to extend such period for two additional five-year terms.

Throughput option 2013

https://investor.cloudpeakenergy.com/press-release/business-development/cloud-peak-energy-announces-option-agreement-ssa-marine-capacity-

investment 2015

https://investor.cloudpeakenergy.com/press-release/announcements/ssa-marine-welcomes-crow-tribe-and-cloud-peak-energy-partners-gateway-pa

[110] This endnote provides source and notes for all of Section 5.6.3.4.

Description of Decker Litigation by Cloud Peak in 2012 Form 10-K:
Cloud Peak Energy Inc., 2012 Annual Report, Form 10-K, especially p. 54-55 (and quotation below):
https://www.sec.gov/Archives/edgar/data/1441849/000104746913001007/a2212694z10-k.htm

> *Decker Litigation*
>
> On July 9, 2012, our wholly-owned indirect subsidiary, Western Minerals LLC ("Western Minerals"), filed a lawsuit in the U.S. District Court for the District of Montana (Billings Division), against KCP Inc. ("KCP"), its 50% joint-venture partner in the Decker mine in Montana. Western Minerals also named as defendants KCP's parent companies, Ambre Energy North America, Inc. ("Ambre N.A.") and Ambre Energy Limited ("Ambre Limited" and together with Ambre N.A. "Ambre"). […]
>
> On August 23, 2012, KCP and Ambre N.A., filed an amended answer to Western Minerals' complaint, replacing the original answer they filed on July 30, 2012. In their amended answer, KCP and Ambre N.A. deny the principal allegations of Western Minerals. Additionally, KCP asserted six counterclaims against Western Minerals […].
>
> On December 5, 2012, we and Ambre Limited announced that our respective companies have entered into agreements for Ambre Limited to purchase our 50% interest in the Decker mine and related assets and assume all reclamation liabilities. The agreements will also provide for the joint resolution and dismissal of the pending Decker litigation upon closing of the transaction. Closing is expected to occur in the first half of 2013, subject to various closing conditions.

Description of Decker Litigation and Status of Decker Acquisition by Cloud Peak and Ambre in August 2013 Press Release:

Cloud Peak Energy and Ambre Energy, Press Release: "Cloud Peak Energy and Ambre Energy Announce Voluntary Dismissal of Lawsuit without Prejudice and Indefinite Delay and Ongoing Discussions Regarding Ambre Energy's Potential Purchase of Decker Mine Interest from Cloud Peak Energy," August 28, 2013: https://investor.cloudpeakenergy.com/press-release/cloud-peak-energy-and-ambre-energy-announce-voluntary-dismissal-lawsuit-without-prejud

> Cloud Peak Energy Inc. […] and Ambre Energy Limited […] today announced that Ambre Energy's purchase of Cloud Peak Energy's 50% interest in the Decker Mine in Montana is not expected to be completed for the foreseeable future.
>
> The potential transaction was initially announced by the companies on December 5, 2012. […]
>
> this potential transaction has not been completed and is not expected to be completed in the foreseeable future. […] the timing of any potential closing was uncertain and anticipated to depend on Ambre's ability to replace Cloud Peak Energy's outstanding reclamation and lease bonds for the Decker Mine. The companies continue to be in discussions and have jointly dismissed the previously disclosed Decker litigation without prejudice to allow time for their ongoing discussions and evaluations.

Decker Litigation: Western Minerals (Cloud Peak subsidiary) Complaint in July 2012: *Western Minerals LLC v. KCP, Inc.; Ambre Energy North America, Inc.; and Ambre Energy Ltd.*, US District Court, District of Montana Billings Division, Case No. CV-12-85-BLG-RFC-CSO, Complaint and Jury Demand, July 8, 2012, especially ¶¶17, 67-68, 75-78, 82-83, 98-101 (excepted below): http://media.oregonlive.com/environment_impact/other/CloudPeakSuit.pdf

> 17. […] the Ambre Entities seek to unilaterally force a significant change in the long-standing direction of the Decker Mine and its associated business and financial risks by redeveloping and expanding the mine for planned future Asian exports.
>
> […]
>
> 47. Western Minerals and KCP are herein referred to as "Venturers."
> […]
>
> 67. The Decker Mine has historically been a customer-limited mine. Prior to August 2011, the only existing coal sales contract for coal from the Decker Mine

was with Detroit Edison ("DE Contract"). The DE Contract is set to expire at the end of 2013.

68. Due to a combination of operational and economic reasons, for the last two years, the Mine Plan for the Decker Mine has been to cease all coal sales upon termination of the DE Contract and transition to full final reclamation of the Decker Mine at the end of 2013.

[…]

75. The Ambre Entities' loosely defined export redevelopment proposal lacks basic information and transparency and is built upon a foundation of self-dealing among the Ambre Entities.

76. The Decker Mine has historically incurred higher costs to produce coal than similarly situated competitors.

77. The factors in these higher costs were recognized by Ambre North America's predecessor in interest, Level 3.

78. Specifically, Level 3 disclosed the following in its 2010 and 2011 Form 10-K filings: the Decker Mine is served by a single railroad, whereas many of its western coal competitors are served by two railroads and such competitors' customers often benefit from lower transportation costs because of competition between railroads for coal hauling business. Level 3 also disclosed that other western coal producers – particularly those in the PRB of Wyoming – have lower stripping ratios (the amount of overburden that must be removed in proportion to the amount of minable coal) than the Decker Mine, often resulting in lower comparative costs of production. Level 3 reported that, as a result of these factors, production costs per ton of coal at the Decker Mine can be as much as four and five times greater than production costs of certain competitors.

[…]

82. The Decker Coal Company sold the following tons of coal in the years indicated: 2007 – 7.0 million tons; 2008 – 6.6 million tons; 2009 – 4.6 million tons; 2010 – 2.8 million tons; and 2011 – 3.0 million tons.

83. The historical downward coal sales tonnage trend is a product of the non-competitive nature of marketing coal from the Decker Mine on the domestic market.

[…]

98. Redevelopment of the Decker Mine would require significant capital costs, and associated risk, for both Venturers.

> 99. Redevelopment of the Decker Mine would constitute a drastic change from the long-standing Mine Plan.
>
> 100. Redevelopment of the Decker Mine would involve significant risks for both Venturers related to future increased reclamation costs and liabilities.
>
> 101. The risks to Western Minerals are increased by the potential financial instability of the Ambre Entities. […] on April 2, 2012, according to Ambre Limited's own auditor, "There exists significant uncertainty whether [the Ambre Entities] would be able to continue as a going concern" due to financial problems. […] "the group's accounts highlight the risky nature of resources investments."

Decker Litigation: Ambre Answer, Counterclaim and Complaint in July 2012
Western Minerals LLC v. KCP, Inc.; Ambre Energy North America, Inc.; and Ambre Energy Ltd., US District Court, District of Montana Billings Division, Case No. CV-12-85-BLG-RFC-CSO, Answer, Counterclaim and Third-Party Complaint, July 30, 2012, especially p. 43, ¶22 (see also endnote 403):
http://publish.generationhub.com/document/2012/08/01/Ambre%20Response%20Filing.pdf

> Due to the cost of reclaiming the land comprising the Decker Mine, closing the Decker Mine would be significantly more expensive […] than would the continuation of mining activity.

[111] Prior to the acquisition 2011 acquisition by AENA, Level 3 had been the operator and had contracted with Kiewit Mining Group Inc. to provide operation and management services. With the 2011 acquisition, AENA became the operator of the Decker Mine and also the Black Butte Mine. The operator has responsibility for the day-to-day operations of the mine (see also Lighthouse 2018 Complaint, ¶¶39, 43 and endnote 85).

[112] Cloud Peak's Complaint in Decker litigation specifically refers to the Level 3 Form 10-K disclosures also discussed in this report (Section 5.5.3).

[113] Cloud Peak Complaint in Decker Litigation, ¶83 (see endnote 110) (bold added for emphasis).

[114] Cloud Peak Complaint in Decker Litigation, ¶17 (see endnote 110) (bold added for emphasis).

[115] Cloud Peak Complaint in Decker Litigation, ¶75 (see endnote 110) (bold added for emphasis).

[116] Cloud Peak Complaint in Decker Litigation, ¶101 (see endnote 110) (bold added for emphasis).

[117] Ambre Energy, Annual Reports, 2011 (financial year ending 30 June 2011); 2012 (financial year ending June 30, 2012); period 1 July 2012 to 31 December 2012; 2013 (year ending 31 December 2014); 2014 (year ending 31 December 2014)

http://ambreenergy.com.au/wp-content/uploads/2015/08/annualreport2011_ae_webversion_final.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ambre_energy_limited_annual_report_30_june_2012_lr.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ambre_energy_report_6_mths_to_31dec2012_final.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ael_annual_report_2013_final.pdf

Financial Year Ended 30 June 2011, pp. 101-102

> **Material uncertainty regarding […] going concern**
>
> a loss of $23,129,300 for the year. […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern […].

Financial Year Ended 30 June 2012, pp. 78-79

> **Material uncertainty regarding […] going concern**
>
> […]
> The entity has recorded a loss of $65,367,000 for the year. […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern […].

Financial Year Ended December 31, 2012, pp. 80-81

> **Material uncertainty regarding […] going concern**
>
> […]
> The […] entity has recorded a loss of $32,0002,000 for the six month period, and current liabilities exceed current assets by $19,284,000 at period end. […] there exists substantial uncertainty whether Ambre Energy Limited and its controlled entities would be able to continue as a going concern […].

Financial Year Ended December 31, 2013 (pdf, p. 81)

> **Independent Auditor's Report**
> […]
> **Material uncertainty regarding going concern**
>
> […] the results recorded […] in the financial report include a recorded loss for the period of $66,414,000 and net operating cash outflows of $28,328,000. Prima facie, these conditions indicate a material uncertainty regarding the […] entity's ability to continue as a going concern.

118 Id.

119 Id.

120 Id.

121 Subsequent to this acquisition, RCF owns 92% of AENA (now known as Lighthouse), with the remaining 8% owned by shareholders of the Australian company. See endnote 67 and Complaint in federal litigation (footnote 1). See also Sections 5.3 and 5.6.6 regarding RCF.

122 See endnote 123, especially Form 5057A Filing with the Australian Securities & Investment Commission, November 2014, Annexure B.

123 AENA was a subsidiary of Ambre Energy, an Australian public company. https://ambreenergy.com.au/

The following disclosures required in Australia provide information regarding Ambre Energy and RCF as part of the 2014 acquisition and previous transactions during 2011-2014:

Ambre Energy, Form 5057A Filing with the Australian Securities & Investment Commission, November 2014; http://media.oregonlive.com/environment_impact/other/Ambre%20filing.pdf

Ambre Energy, Form 2560 Filing with the Australian Securities & Investment Commission, November 2013; http://www.documentcloud.org/documents/1020835-ambre-report.html#document/p84/a145986
This Form 2560 Filing includes BDO Corporate Finance (QLD) Ltd., Ambre Energy Limited: Independent Expert's Report, November 7, 2013 (pdf pp. 44-184); as part of the transactions approved in December 2013, AEL retained an independent expert (BDO) to value AENA assets (see also Section 5.5.6 and endnote 94);

Ambre Energy, Annual Reports, 2011 (financial year ending 30 June 2011); 2012 (financial year ending June 30, 2012); period 1 July 2012 to 31 December 2012; 2013 (year ending 31 December 2014); 2014 (year ending 31 December 2014)

http://ambreenergy.com.au/wp-content/uploads/2015/08/annualreport2011_ae_webversion_final.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ambre_energy_limited_annual_report_30_june_2012_lr.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ambre_energy_report_6_mths_to_31dec2012_final.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ael_annual_report_2013_final.pdf

http://ambreenergy.com.au/wp-content/uploads/2015/08/ael_annual_report_4jun2015_final.pdf

The 2014 acquisition was via a term sheet dated August 28, 2014, as subsequently recorded in a definitive agreements dated November 11, 2014, subject to approval by Ambre shareholders which was provided at the Annual General Meeting on December 22, 2014. Ambre 2014 Annual Report, p. 35.

[124] The $16.5 million was used to pay off loans from Korean lenders that were coming due and which AENA would otherwise have been unable to repay. Thus, these loans needed to be repaid to avoid triggering a default. The Korean lenders were two utilities: Korea Southern Power Company (KOSPO) and Korea Southeast Power Company (KOSEP), which are both wholly owned subsidiaries of Korea Electric Power Corporation (KEPCO)). These two utilities also have contracts to buy coal from Lighthouse.

See Section 9.4; Ambre Energy, Form 5057A Filing with the Australian Securities & Investment Commission, November 2014 (endnote 123) , ¶9(b); Ambre Energy, Annual Reports (endnote 123): 2012 (financial year ending June 30, 2012), p. 14; period 1 July 2012 to 31 December 2012, p. 9; BDO, Independent Expert's Report (endnote 94).

[125] Net funds = $0.737 million = $18 million - $16.603 million - $0.66 million, as per Ambre Energy, Form 5057A Filing with the Australian Securities & Investment Commission, November 2014, Annexure C, Note 1 ($000): http://media.oregonlive.com/environment_impact/other/Ambre%20filing.pdf

RCF VI purchases 73.59% of common stock of AENA for	18,000
AEL repays convertible notes and accrued interest and other expenses	(16,603)
Transaction costs and repayment of advances pre closing of sale	(660)

[126] After the transfer, RCF had a 92% share of AENA. Prior to the transfer, RCF had a 26.41% share of AEL (AENA's Australian Parent company) and thus already owned

26.41% of AENA. Hence, the transfer increased RCF's ownership share of AENA by 65.59% (92%-26.41%). In exchange for 65.59% of AENA, RCF provided net funds of $0.737 million (see endnote 125). On this basis, value of AENA (100% ownership) = $1.124 million = $0.737 million/65.59%.

The transactions between RCF and AENA were complex, and a somewhat higher valuation could be estimated. Aside from AENA, AEL owned some other assets, notably oil shale leases (which were sold for $4 million) and farm properties (which were sold for A$1.8 million). http://ambreenergy.com.au/wp-content/uploads/2015/08/ael_annual_report_4jun2015_final.pdf pp. 5-6. Prior to the transfer, RCF had a 26.41% share of AEL, so RCF share of AEL's assets other than AENA could be valued at over $1 million.

[127] See endnote 123.

[128] As explained in endnote 124, the Korean lenders are the two utilities which have contracts to buy coal from Lighthouse.

[129] Ambre Energy, Form 5057A Filing with the Australian Securities & Investment Commission, November 2014, ¶34, (pdf pp. 12-13) (underlining added for emphasis). http://media.oregonlive.com/environment_impact/other/Ambre%20filing.pdf

[130] This endnote provides sources for the entire Section 5.6.4.3.

https://download.asic.gov.au/media/1240152/rg111-30032011.pdf

https://www.bdo.com.au/getattachment/Services/Advisory/Corporate-Finance/Valuation-Services/Independent-Experts-Reports-(IERs)/1101_INDEPENDENT-EXPERTS-REPORT-E-BOOK_0618_v4.pdf.aspx?lang=en-AU

http://www.documentcloud.org/documents/1020835-ambre-report.html#document/p84/a145986 p. 11, ¶47 (pdf p. 20); BDO IER, p. 3 (pdf p. 57); see also endnote 123.

[131] BDO Corporate Finance (QLD) Ltd., Ambre Energy Limited: Independent Expert's Report, November 7, 2013, especially pp. vi-2 (Financial Services Guide and Introduction) and pp. 97-104 (Appendix F-Valuation of the Black Butte Mine). http://www.documentcloud.org/documents/1020835-ambre-report.html#document/p84/a145986 (pdf pp. 44-184 (BDO report)).

BDO is a global accounting firm; BDO Corporate Finance (QLD) Ltd. holds an Australian Financial Services License to provide financial product advice and deal in financial products. https://www.bdo.com.au/en-au/services/advisory/corporate-finance

[132] The Western Bituminous region includes Colorado, Utah, and southern Wyoming, coinciding with the Uinta Basin. Arch Coal, 2017 Annual Report, Form 10-K, p. 9

https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

133 News Release: Arch Coal, Inc. Reports Fourth Quarter and Full Year 2010 Results, January 28, 2011 (underlining added for emphasis)
http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1521252

Similar content is provided in
http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1515428

134 This endnote provides sources and notes for entire paragraph.

$59.511 million loss = $25.0 million to acquire 38% share in 2011 + $34.511 million subsequent contributions (2011: $3.477 million; 2012: $8.798 million; 2013 $6.476 million; 2014: $6.742 million; 2015 $7.052 million; 2016 $1.966 million). Arch recorded a $38.025 million total loss on its equity investment in 2015 second quarter; $21.486 million was previously expensed. Arch Coal, Annual Reports, Form 10-K, especially

2011 10-K/A (Amended), pp. F-21—F-22
https://www.sec.gov/Archives/edgar/data/1037676/000104746912004613/a2208896z10-ka.htm

2013 10-K, pp. F-21—F-22
https://www.sec.gov/Archives/edgar/data/1037676/000104746914001604/a2218540z10-k.htm

2015 Form 10-K, p. F-23
https://www.sec.gov/Archives/edgar/data/1037676/000110465916105176/a15-23239_210k.htm

2017 Form 10-K, p. F-32:
https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

> The Company previously held a 38% ownership interest in Millennium Bulk Terminals-Longview, LLC ("Millennium") […] During the second quarter of 2016, the Company recorded an impairment charge of $38.0 million representing the entire value of its equity investment as the Company relinquished its ownership rights in exchange for future throughput rights through the facility when completed.

See also endnote 135.

135 This endnote provides sources for entire paragraph.

Debtors Motion for Transfer of Assets, May 26, 2016, especially pp. 4-6:
https://cases.primeclerk.com/archcoal/Home-DownloadPDF?id1=MzQ4MzQw&id2=0

> Construction and development of the terminal is a long-term and capital-intensive project, and Arch Coal West is subject to periodic capital calls in respect of its Membership Interests in Millennium. […]
>
> The sale of the Membership Interests will relieve Arch Coal West of the obligation to make periodic capital contributions to Millennium. Additionally, Arch Coal, Inc. will enter into an agreement […] to receive an option to utilize up to 10% of the throughput capacity of the Terminal for a period of ten years, with the option to extend such period for two additional five-year terms, at a cost no less favorable than any other customer of the Terminal with a throughput contract with term business. […]
>
> The Debtors do not believe that they could achieve more favorable terms for the sale of the Membership Interests, especially given that under Millennium's operating agreement, a sale of the Millennium Interests to a third party would be subject to a right of first refusal of LHR.

https://cases.primeclerk.com/archcoal/Home-DownloadPDF?id1=MzUwNDA4&id2=0
especially Order of US Bankruptcy Judge approving transfer of Arch Membership Interest to Lighthouse (Exhibit D, pdf pp. 28-35).

Lighthouse et al. v. Inslee et al., US District Court, Western District of Washington at Tacoma, Case No. 3.18-dv-05005-RJB, State Defendants' Interrogatories and Requests for Production to Plaintiffs and Plaintiffs Objections, Answers and Responses Thereto; July 18, 2018, Interrogatory Response 3:

> Lighthouse […] may provide export capacity to third-party shippers Cloud Peak Energy and Arch Coal Inc. at the Millennium Bulk Terminal if the Project is completed. […] Arch Coal Inc. has an option to export up to ten percent of the throughput capacity of the Project for a period of ten years, with the option to extend such period for two additional five-year terms.

[136] Arch's ownership share (38%) of total construction cost ($680 million estimated); this assumes total construction cost remains to be spent (see endnote 133, 134, and 428).

[137] This endnote provides sources for entire paragraph. See endnote 135.

[138] See endnote 134

[139] As explained in Section 6.4.4, Cloud Peak Energy received a Millennium throughput option when Lighthouse acquired 50% of the Decker Mine in 2014. In consideration of consensus projections of weak export pricing and a weak outlook for coal exports, this throughput option was written off (estimated to have no economic value) by Cloud Peak in 2015 and subsequently. The Millennium throughput option received by Cloud Peak Energy (up to 7 MMTPY, for ten years with option to extend for four additional five-year terms) is much larger than the option received by Arch (up to 4.4 MMTPY, for ten years

with option to extend for two additional five-year terms). Pricing provisions have not been disclosed for the Cloud Peak throughout option, but pricing is likely to be as or more favorable than for Arch (cost no less favorable than other similar customers).

[140] https://cases.primeclerk.com/archcoal/Home-DownloadPDF?id1=MzQ4MzQw&id2=0 p. 6

> The Debtors do not believe that they could achieve more favorable terms for the sale of the Membership Interests, especially given that under Millennium's operating agreement, a sale of the Millennium Interests to a third party would be subject to a right of first refusal of LHR.

[141] See endnote 67.

[142] http://www.resourcecapitalfunds.com/investment-considerations

http://www.resourcecapitalfunds.com/faq#toggle-id-15

[143] See endnotes 67 and 68.

[144] Id.

[145] See discussion in Section 10.5.4 and endnote 146.

[146] Robert Godby et al., Centre for Energy Economics and Public Policy, The Impact of the Coal Economy on Wyoming, Prepared for: Wyoming Infrastructure Authority, February 2015, p. 5. https://www.uwyo.edu/cee/_files/docs/wia_coal_full-report.pdf [referenced in footnote 16 of the Complaint]; referred to in this report as "the CEE Study." (underlining added for emphasis).

[147] [footnote 15 in original] See http://www.oregonlive.com/environment/index.ssf/2014/11/ambre_energy_selling_oregon_wa.html and its filing at http://media.oregonlive.com/environment_impact/other/Ambre%20filing.pdf. [See also endnote 148].

[148] See Section 5.6.4 and endnotes 121-129 in this report for review and analysis of the November 2014 Ambre Energy regulatory filing identified in the CEE Study (see endnote 147).

[149] [footnote 16 in original] Cloud Peak and Ambre Energy announced the sale of Cloud Peak's interest in their Decker Montana mine in September 2014. Ambre afterward has apparently divested these interests as previously noted. http://investor.cloudpeakenergy.com/press-release/business-development/cloud-peak-energy-and-ambre-energy-announce-signing-deal-ambre-en. With respect to losses on recent coal exports, see Gillette News Record, December 14, 2014, http://www.gillettenewsrecord.com/news/local/article_6c83df44-3a6b-5bdd-8274-a1dacd800d02.html. For additional comment, see Sanzillo 2014 [Sanzillo, Tom (2014)

"No Need for New U.S. Coal Ports: Data Shows Oversupply in Capacity," Institute for Energy Economics and Financial Analysis (IEEFA), November 19, 2014, see endnote 32 in this report].

[150] [footnote 17 in original] See Sanzillo (2014b) for a critical investor newsletter regarding the financial condition of major Powder River Basin operators. [Sanzillo, Tom (2014b) "20 Fourth-Quarter Questions for Powder River Basin Coal Producers," Institute for Energy Economics and Financial Analysis (IEEFA), November 11, 2014.]

[151] CEE Study (endnote 145), p. 59 (underlining added for emphasis); similar content is also provided on p. 5.

The CEE Study is cited in the Complaint in reference to the economic (including employment) benefits of Wyoming coal production (as a footnote to ¶77).

For additional information on this study, see Section 10.5.4 and endnote 444.

[152] See Section 4.8 and endnote 52.

[153] Over $240 million in losses includes $59.511 million for Millennium (see endnote 134), $158.9 million for Otter Creek coal reserve leases (see endnote 163), and $22.155 million for Tongue River (see endnote 167).

[154] http://www.archcoal.com/restructuring/

http://www.archcoal.com/restructuring/pdfs/Final%20ACI%20Agreement%201-11-16.pdf

https://cases.primeclerk.com/archcoal/

[155] $735 million or more in additional capital costs includes $258 million for Millennium (see endnote 162), $336 million or more for Otter Creek Mine (see endnote 170), and $140-240 million for Tongue River Railroad (see endnote 168).

[156] Cloud Peak Energy, Q2 2013 Results - Earnings Call Transcript. Seeking Alpha, July 30, 2013 (underlining added for emphasis). https://seekingalpha.com/article/1585522-arch-coal-management-discusses-q2-2013-results-earnings-call-transcript?part=single

[157] See endnote 155.

[158] https://cases.primeclerk.com/archcoal/

Arch Coal, 2017 Annual Report, Form 10-K, pp. 6-7 https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

[159] The Western Bituminous region includes Colorado, Utah, and southern Wyoming, coinciding with the Uinta Basin. See endnote 132.

[160] News Release: Arch Coal, Inc. Reports Fourth Quarter and Full Year 2010 Results, January 28, 2011 (bold in original, underlining added for emphasis). http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1521252

See also

http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1515428

http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1517028

FEIS, SEPA Coal Market Assessment Technical Report, pp. 2-12, 2-13.

[161] See endnote 134.

[162] Arch's ownership share (38%) of total construction cost ($680 million estimated); this assumes total construction cost remains to be spent (see endnotes 133, 134, and 428).

[163] Otter Creek coal reserves are divided in a checkerboard pattern, with roughly half owned by Great Northern Properties (GNP) and the other half by State of Montana. In November 2009, Arch leased reserves from GNP, which will receive a front-end bonus of $73.1 million ($0.10 per ton for 731 million tons of sub-bituminous coal, payable in equal annual installments over a five-year period). In March 2010, Arch leased reserves from State of Montana for a one-time bonus of $85.8 million to be paid in April 2010 ($0.15 per ton, based on 572 million tons of reserves). On this basis, Arch paid a total of $159 million for about 1.3 billion tons of reserves, so about $0.12 per ton ($0.11 per metric ton). Based on other somewhat higher estimates for total amount of coal reserves (e.g. 1.4 billion tons in Arch 2010 Form 10-K), the cost per ton of reserves would be about $0.11 per ton ($0.10 per metric ton).

https://www.sec.gov/Archives/edgar/data/1037676/000095012311020753/c62065e10vk.htm p. F-13

http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1355044

http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=1403818

[164] See endnote 167.

[165] http://deq.mt.gov/Land/ottercreek
http://deq.mt.gov/Portals/112/Land/OtterCreek/Documents/Revised%20Scoping%20Report%20_%2006192012.pdf p. 3.

[166] Tongue River Railroad DEIS, April 2015

https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/Ch01_Purpose-Need.pdf especially p. 1-5 https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/Ch02_Proposed+Action+and+Alternatives.pdf especially p. 2-1

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf especially p. C.1-12; Chapter 6 (C.6-1—C.6-43).

167 This endnote provides sources and notes for the entire paragraph.

$22.155 million loss = $12.989 million to acquire 35% share in 2011 + $9.166 million subsequent contributions (2012: $1.708 million; 2013 $4.004 million; 2014: $2.541 million; 2015 $0.913 million). Arch recorded a $21.325 million total loss on its equity investment in 2015 third quarter; $0.830 million was previously expensed. Arch Coal, Annual Reports, Form 10-K, especially

2011 10-K/A (Amended), pp. F-21—F-22; https://www.sec.gov/Archives/edgar/data/1037676/000104746912004613/a2208896z10-ka.htm

2013 10-K, pp. F-21—F-22; https://www.sec.gov/Archives/edgar/data/1037676/000104746914001604/a2218540z10-k.htm

2015 Form 10-K, p. F-23; https://www.sec.gov/Archives/edgar/data/1037676/000110465916105176/a15-23239_210k.htm

2017 Form 10-K, p. F-32. https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

168 Arch's ownership share (35%) of total construction cost ($416-698 million range assumed in DEIS economic analysis); (see endnotes 166 and 167).

169 http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=2147605 (underlining added for emphasis)

> Arch […] is suspending efforts to secure a mining permit for the Otter Creek coal reserves near Ashland in southeastern Montana, due to capital constraints, near-term weakness in coal markets and an extended and uncertain permitting outlook. […]
>
> given current conditions, Arch can no longer devote the time, capital and resources required to develop a coal mine on the Otter Creek reserve block.

See also http://deq.mt.gov/Land/ottercreek

170 $336.2 million capital costs estimated in DEIS economic analysis for 5 year construction and start-up period, with virtually all costs in Year -1 (p. C.6-26): $8.5

million (Year -3) + $322.3 million (Year -1) + $1.8 million (Year 1) + $3.6 million (Year 2); together with later costs ($69.5 million in Year 10), total estimated capital costs are $405.8 million (see endnote 166).

[171] This endnote provides sources for the entire Section 6.3.3.

Arch Coal, 2017 Annual Report, Form 10-K, pp. 6, 8, 14-16, 18, 53, 57-59 https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm;

Arch Coal, Investor Presentation, August 2018, pp. 12-17, 23-26 http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9NjkwMjE0fENoaWxkSUQ9NDA5OTk2fFR5cGU9MQ==&t=1

http://www.archcoal.com/aboutus/coalsupplyregions.aspx

See also Table 3, Table 4, and endnotes 55-64 for information on 2016 and 2017 Arch Coal production.

[172] http://www.archcoal.com/aboutus/coalsupplyregions.aspx

[173] This endnote provides sources and notes for the entire paragraph.

Id.; Table 1; Table 2;

Arch Coal website (bold in original) http://www.archcoal.com/aboutus/transportation.aspx

> Arch Coal […] can export coal from the east, west and gulf coasts. Coal […] can be stored and transloaded cost-effectively through Dominion Terminal Associates (DTA) located in Newport News, Va. […] **Key Facility for Overseas Export**

Dominion Terminal Associates (DTA) is owned by 35% by Arch and 65% by Contura (see Section 6.5.3).

http://news.archcoal.com/phoenix.zhtml?c=107109&p=irol-newsArticle&ID=2252254;

DTA website http://www.dominionterminal.com/Facility%20Description.htm; Contura Energy, Company Overview, April 2018, pp. 11, 19 https://conturaenergy.com/wp-content/uploads/2018/04/Contura-Company-Overview-Deck-UPDATED-April-2018.pdf

[174] Metallurgical coal (only about 8% of Arch production (tons)) provides a large and growing portion of overall Adjusted EBITDA (almost half in 2017 and projected to be about 60% in 2018). Arch defines

Adjusted EBITDA as net income before net interest expense, income taxes, depreciation, depletion and amortization, accretion on asset retirement obligations, amortization of sales contracts and reorganization items. Arch Coal, Investor Presentation, August 2018 (endnote 171), pp. 9, 23, 25, 29.

[175] Arch Coal, 2017 Annual Report, Form 10-K (endnote 171), pp. 69, F-60; Arch Coal, Investor Presentation, August 2018 (endnote 171), especially p. 9:

> We continue to maintain very low levels of capital at our thermal operations and expect to do so going forward

[176] Arch Coal, Investor Presentation, August 2018 (endnote 171), pp. 3-6, 9, 22-27.

[177] Take-or-pay commitments will be discussed in more detail in Section 7.4.2.

[178] Arch Coal, Annual Report, Form 10-K, 2017 (endnote 171), p. 33 (bold in original).

[179] Id., p. 39.

[180] Arch market capitalization has ranged between $1.6 to $2.1 billion in recent months. https://ycharts.com/companies/ARCH/market_cap

https://www.zacks.com/stock/chart/arch/fundamental/market-cap

[181] Cloud Peak Energy sometimes uses the acronym CPE (see e.g., endnote 185), but is also known by its stock symbol (CLD; see e.g., endnote 211).

[182] This endnote provides information for all of Section 6.5.1.

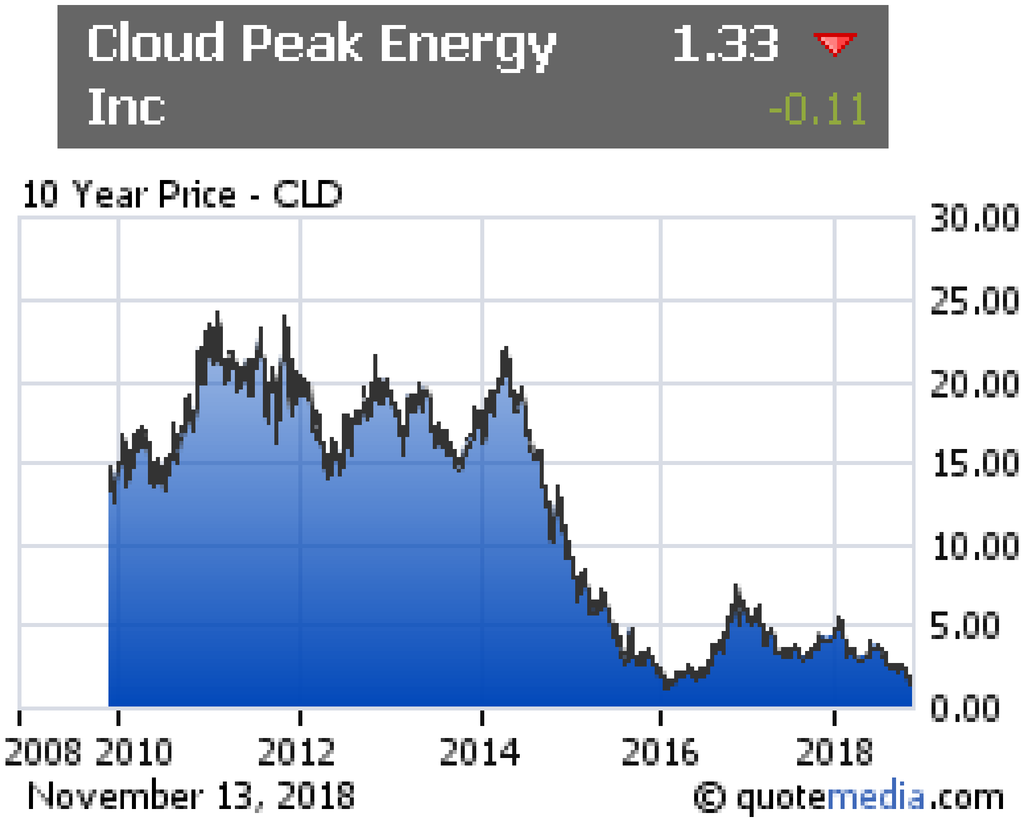
https://www.prnewswire.com/news-releases/peabody-energy-and-ssa-marine-enter-into-long-term-agreement-for-powder-river-basin-coal-exports-117106678.html

https://www.bellinghamherald.com/news/local/article71696852.html

https://coalstop.com/2016/05/05/gateway-pacific-terminal-unraveling-the-mystery-of-peabodys-relationship-with-ssa-marine/

[183] https://www.zacks.com/stock/chart/CLD/fundamental/market-cap

Data from this source matches market capitalization and other stock information on the Cloud Peak Energy website: https://investor.cloudpeakenergy.com/stock-information



CPE market capitalization is $109.12 million on November 12, 2018 (based on closing stock price of $1.44 per share and 75,778,186 shares). CPE market capitalization then dropped to $100.78 million on November 13, 2018 (based on closing stock price of $1.33 per share and 75,778,186 shares), but it was not feasible to comprehensively update the report to incorporate this new information.

Figure 11 shows market capitalization starting in 2010. Cloud Peak shares began on trading on the New York Stock Exchange on November 20, 2009, under the ticker symbol "CLD".

Cloud Peak Energy, Press Release: "Cloud Peak Energy Announces Pricing of Its Initial Public Offering," November 20, 2009 https://investor.cloudpeakenergy.com/press-release/corporate/cloud-peak-energy-announces-pricing-its-initial-public-offering

[184] Cloud Peak Energy, Investor Presentation, October 2018, p. 26. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

Similar content is provided in:

Cloud Peak Energy, Investor Presentation, July 2018, p. 25
https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q218_Investor_Presentation_FINAL.pdf

[185] FEIS Vol. IV: Comments on the Draft EIS, General Public Part 2, Cloud Peak Energy, June 10, 2016 (Comment 2447), pdf p. 310 (underlining added for emphasis).
http://www.millenniumbulkeiswa.gov/assets/07-volume-iv-appendix-b-general-public-part-22.pdf

[186] Id., pp. 312-314 (underlining added for emphasis); this content is also provided in FEIS Vol. IV: Responses to Comments on the Draft EIS, Comment CMA-106, pp. 5.8-65—5.8-67.

[187] Cloud Peak Energy, Investor Presentation, October 2018, p. 12.
https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

Similar content is provided in:

Cloud Peak Energy, Investor Presentation, July 2018, p. 12
https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q218_Investor_Presentation_FINAL.pdf

[188] This endnote provides source and notes for all of Section 6.4.3.

Cloud Peak Energy Inc., 2014 Annual Report, Form 10-K, especially p. 7:
https://www.sec.gov/Archives/edgar/data/1441849/000110465915011392/a15-1789_110k.htm

> As part of the Decker Mine divestiture transaction, we were granted a throughput option for up to 7.7 million tons per year at the proposed Millennium Bulk Terminals coal export facility in Washington State. The proposed new coal export facility is currently in the permitting stage and is planned to be developed in two phases. Our option covers up to 3.3 million tons per year of capacity during the first phase of development and an additional 4.4 million tons per year once the second phase of development is reached. Our throughput capacity will have an initial term of 10 years, with four renewal options for five-year terms.
>
> […]
>
> We also have a throughput option agreement with SSA Marine, which provides us with an option for up to 17.6 million tons of capacity per year through the planned dry bulk cargo Gateway Pacific Terminal at Cherry Point in Washington State. Our potential share of capacity will depend upon the ultimate capacity of the terminal and is subject to the terms of the option agreement. The terminal will accommodate cape size vessels.

Cloud Peak Energy Inc., 2015 Annual Report, Form 10-K, especially pp. 81, 93 (and quotation below)
https://www.sec.gov/Archives/edgar/data/1441849/000110465916097811/a15-23313_110k.htm

> On August 13, 2015, we announced that we and the Crow Tribe joined SSA Marine as 49% partners in GPT. Under the new ownership structure, SSA Marine remained the majority owner, retaining 51% of the equity. The Crow Tribe has an option to secure up to 5%, with a corresponding reduction in our ownership. For our 49% ownership interest, we paid $2 million upon signing and will pay all future permitting expenses up to $30 million, which we anticipate will cover such expenses through 2019. Thereafter, the owners will share any permitting expenses in excess of $30 million in proportion with their ownership interests. As of December 31, 2015, we have paid $6.6 million toward permitting expenses as a partner. [p. 81]
>
> […]
>
> In consideration of consensus projections of weak export pricing, a weak outlook for coal exports, and our associated decision to amend the port and rail contracts to require no export shipments from 2016 through 2018 in exchange for ongoing quarterly payments less than the prior take-or-pay requirements, we determined that the carrying values of certain intangible assets in our Logistics and Related Activities segment were impaired. We have written off the port access rights related to Westshore, MBT, and GPT of $33.4 million, $5.0 million, and $13.8 million, respectively, during the year ended December 31, 2015.
>
> Due to the factors described above, we have fully impaired our equity investment in GPT by recording a charge of $6.0 million during the fourth quarter of 2015. […]
>
> *Westshore Terminals*
>
> In August 2014, we paid $37.0 million to Coal Valley Resources, Inc. (“CVRI”), a unit of Westmoreland Coal Company, to terminate its throughput agreement with Westshore. In a related transaction, we amended our existing throughput agreement with Westshore to increase our annual committed volumes from 2.8

> million tons to 6.3 million tons initially and increasing to 7.2 million tons in 2019. In addition, we extended the term of our throughput agreement from the end of 2022 through the end of 2024. In August 2014, we also amended our existing transportation agreement with BNSF related to shipments from the Spring Creek Mine to Westshore to align the committed volumes with the terms of the amended Westshore agreement.
>
> We initially capitalized the $37.1 million payment as an intangible asset and began amortizing it in 2015 on a straight line basis over the term of the contract. However, as previously described in Note 9, in consideration of consensus projections of weak export pricing, a weak outlook for coal exports and our associated decision to amend the port and rail contracts to require no export shipments from 2016 through 2018 in exchange for ongoing quarterly payments less than the prior take-or-pay requirements, we determined that the carrying value of this intangible asset was impaired. We have written off the Westshore port access rights of $33.4 million during the year ended December 31, 2015. [pp. 93-94]

Lighthouse et al. v. Inslee et al., US District Court, Western District of Washington at Tacoma, Case No. 3.18-dv-05005-RJB, State Defendants' Interrogatories and Requests for Production to Plaintiffs and Plaintiffs Objections, Answers and Responses Thereto; July 18, 2018, Interrogatory Response 3:

> Lighthouse […] may provide export capacity to third-party shippers Cloud Peak Energy and Arch Coal Inc. at the Millennium Bulk Terminal if the Project is completed. Cloud Peak Energy has an option to export up to three million metric tons of coal per year at Stage One of the Project and an additional four million metric tons of coal per year at Stage Two of the Project. Arch Coal Inc. has an option to export up to ten percent of the throughput capacity of the Project for a period of ten years, with the option to extend such period for two additional five-year terms.

Throughput option 2013

https://investor.cloudpeakenergy.com/press-release/business-development/cloud-peak-energy-announces-option-agreement-ssa-marine-capacity-

investment 2015

https://investor.cloudpeakenergy.com/press-release/announcements/ssa-marine-welcomes-crow-tribe-and-cloud-peak-energy-partners-gateway-pa

189 See Figure 14 and endnote 191.

190 Ibid.

191 Cloud Peak Energy, Investor Presentation, October 2018, pp. 13-14. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

Notes in original:

[1] Excludes JERA volumes

[2] Includes JERA volumes

Similar content is provided in:

Cloud Peak Energy, Investor Presentation, July 2018, pp. 13-14 https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q218_Investor_Presentation_FINAL.pdf

192 In Cloud Peak's Earnings Conference Call on Q3 2017 Results, CEO Colin Marshall explained the need for CPE to be cautious and incremental in committing to additional rail and port capacity, and thus increasing pay-or-pay commitments, and that CPE has learned this lesson from past experience: https://seekingalpha.com/article/4117132-cloud-peak-energys-cld-ceo-colin-marshall-q3-2017-results-earnings-call-transcript?part=single

> **Colin Marshall**
>
> So, I think in terms of the expectation is as long as the price is supportive in making some money on it than we will, you know both ourselves the railway and the Westshore with the expectations that we will keep extending those contracts. <u>We got to make sure that we don't get ahead of ourselves and take on too many take or pays recognizing the prices</u>. There is no reason <u>they will at some stage presumably go down to levels they were a year or two ago or last year when we couldn't export</u>. So, we will be cautious about moving those forward, but it is good business at the moment for ourselves, Westshore and the BN and we've tried to adjust those agreements to make sure that will allow us to keep exporting.
>
> So, <u>I think we will look to extend those and update you as we do that, but we will be very cautious about not taking on too much take or pay risk. We've sort</u>

of learnt our lesson on that. In terms of the actual pricing, well there is some variability in the agreements that they announced to let us keep exporting as the price of new customer maybe drops away. I won't give you an exact number, but clearly when it's above $60 that's good, when it is getting down 55-ish and that is a level that's not so good.

So, this is the Indonesian price, the Kalimantan price and obviously what we have seen recently is whilst the Newcastle price has been near terms has been around about $100 and has actually been some steady moment up in the Indonesian price, which is now at 66, which sort of lagged, I guess the New Castle and the web [ph] and that's encouraging because we do see this tightness in the variability and quality and the coal coming out of Indonesia. So overall it is pretty positive and we want to keep sort of rolling things forward that we want to make sure we don't get too far ahead of ourselves […].

193 Cloud Peak Energy, Investor Presentation, October 2018, p. 12. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

Similar content is provided in:

Cloud Peak Energy, Investor Presentation, July 2018, p. 12 https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q218_Investor_Presentation_FINAL.pdf

194 See endnote 109.

195 Cloud Peak Energy, Press Release: "Cloud Peak Energy Modifies Throughput and Transportation Agreements with Westshore Terminals and BNSF Railway," February 15, 2017: https://investor.cloudpeakenergy.com/press-release/corporate/cloud-peak-energy-modifies-throughput-and-transportation-agreements-westshor

Cloud Peak Energy Inc. […], one of the largest U.S. coal producers and the only pure-play Powder River Basin ("PRB") coal company, today announced that Cloud Peak Energy Logistics LLC replaced its throughput agreement with Westshore Terminals Limited Partnership […] and its transportation agreement with BNSF Railway Company ("BNSF").

Under the new agreements, which are effective commencing January 2017 for the throughput agreement and April 2017 for the transportation agreement, Cloud Peak Energy made upfront payments and also committed to minimum payments through 2018. The outstanding undiscounted commitments are approximately $51 million through the current two year term of these agreements.

> Both agreements provide that the parties may extend the agreements through the end of 2019 if elected. In addition, Westshore has certain priority rights on throughput capacity in respect of any export shipments by Cloud Peak Energy through 2024. The original throughput and transportation agreements and underlying take-or-pay commitments, which have now been replaced, previously would have expired at the end of 2024.

"Westshore and BNSF are critical parts of our effort to maintain a viable long-term Asian export business. We value our strong relationships with Westshore and BNSF and appreciate their willingness to work with us. We believe in the long-term opportunity for Asian exports of Powder River Basin coal," said Colin Marshall, Cloud Peak Energy's President and Chief Executive Officer.

[196] This endnote provides information for all of Section 6.5.1.

https://www.prnewswire.com/news-releases/peabody-energy-and-ssa-marine-enter-into-long-term-agreement-for-powder-river-basin-coal-exports-117106678.html

https://www.bellinghamherald.com/news/local/article71696852.html

https://coalstop.com/2016/05/05/gateway-pacific-terminal-unraveling-the-mystery-of-peabodys-relationship-with-ssa-marine/

[197] https://www.prnewswire.com/news-releases/peabody-energy-and-ssa-marine-enter-into-long-term-agreement-for-powder-river-basin-coal-exports-117106678.html

See also endnote 196.

[198] As explained in Sections 5.6.3.4 and 6.4, the Gateway Pacific Project was even larger than Millennium (48 MMTPY for coal and 54 MMTPY for all commodities).

[199] http://ieefa.org/ieefa-update-peabody-continues-to-grapple-with-decline/

[200] This endnote provides information for all of Section 6.5.2.

Westmoreland's PRB mines (Rosebud and Absaloka) are in Montana and supply proximate domestic markets, mostly power plants that are adjacent/nearby (Colstrip and Hardin), but also power plants in the upper Midwest (notably Xcel Energy) that are relatively proximate. See Section 5.5.4; endnotes 87 and 97; http://westmoreland.com/location/absaloka-mine-montana/

Westmoreland Bankruptcy:

http://westmoreland.com/restructuring/
https://www.donlinrecano.com/Clients/wcc/Index

[201] This endnote provides information for all of Section 6.5.3.

Alpha was major PRB producer, went through bankruptcy, has divested PRB mines

This endnote provides sources and notes for the entire paragraph. Dominion Terminal Associates (DTA) is owned by 35% by Arch and 65% by Contura, which began operations in 2016. Contura acquired (DTA) and mines divested by Alpha Natural Resources as part of its Chapter 11 bankruptcy. Contura and Alpha are now seeking to merge.

https://seekingalpha.com/news/3196479-alpha-natural-resources-emerges-bankruptcy

Id.; http://www.nationalcoalcouncil.org/studies/2018/NCC-US-Coal-Exports-2018.pdf p. 64; Dominion Terminal Associates website http://www.dominionterminal.com/Facility%20Description.htm; Contura Energy website https://conturaenergy.com/ including https://conturaenergy.com/wp-content/uploads/2018/04/Contura-Company-Overview-Deck-UPDATED-April-2018.pdf especially p. 19;
Alpha Natural Resources website http://www.alphanr.com/Pages/Default.aspx including http://www.alphanr.com/about/Pages/default.aspx.

See also endnote 173 (DTA).

See Boyd 2011 & maybe 2017

Blackjewel acquired Eagle Butte and Belle Ayr mines from Contura in exchange for Blackjewel assuming reclamation obligations and for zero or possibly negative $21 million direct compensation.

http://ieefa.org/ieefa-update-another-canary-coal-mine/

https://trib.com/business/energy/owner-of-two-major-wyoming-coal-mines-paid-buyer-million/article_891e0735-5811-58d9-8e6e-dbcbe6505418.html

[202] IEA Coal 2017: Analysis and Forecasts to 2022, p.15 (emphasis in original). https://webstore.iea.org/market-report-series-coal-2017

Similar content is provided in IEA Coal 2017: Analysis and Forecasts to 2022, Executive Summary, p. 5 (emphasis in original)
https://webstore.iea.org/download/summary/143?fileName=English-Coal-2017-ES.pdf

[203] IEA Coal 2017, p. 113.

[204] [footnote 2 in original] Thermal coal, also called steam coal, is used for electricity production. Metallurgical coal is used for coking in steel production.

[205] National Coal Council, Advancing U.S. Exports An Assessment of Opportunities to Enhance Exports of U.S. Coal, p. 2. http://www.nationalcoalcouncil.org/studies/2018/NCC-US-Coal-Exports-2018.pdf

[206] This endnote provides sources and notes for the entire paragraph.

International Coal Trade-The Evolution of a Global Market, IEA, 1998, pp. 28-30, especially https://www.iea.org/ciab/papers/coaltrade98.pdf

> US exports have fluctuated widely in a manner that could be sustained by producers for which the export market was secondary to their main domestic market […]

[207] Johannes Trüby and Moritz Paulus, 'Market structure scenarios in international steam coal trade', *Energy Journal*, 2012, Vol. 33/3, p. 94 (bold and capitalization in original, underlining added for emphasis). http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Zeitschriften/2012/Energy_Journal_2012_Vol_33_3_Market_Structure_Scenarios.pdf

Johannes Trüby plays a lead role on coal and other energy analysis at IEA; see e.g., IEA WEO (2017, p. 5; 2016, p. 5); and Coal Medium-Term Market Reports (Coal 2017, p. 4; 2016, p. 5; 2012, p. 5; 2011, p. 4.

Together with Johannes Trüby, Moritz Paulus was a main author on IEA Coal Medium-Term Market Report 2011 (p. 4).

https://www.iea.org/publications/freepublications/publication/MTCoalMR2012_free.pdf

https://www.iea.org/publications/freepublications/publication/Medium_Term_Coal_Market_Report2011.pdf

[208] FEIS Vol. IV: Comments on the Draft EIS, General Public Part 2, Cloud Peak Energy, June 10, 2016 (Comment 2447), p. 310 (pdf) (underlining added for emphasis). http://www.millenniumbulkeiswa.gov/assets/07-volume-iv-appendix-b-general-public-part-22.pdf

[209] Id., pp. 312-314 (pdf) (underlining added for emphasis); this content is also provided in FEIS Vol. IV: Responses to Comments on the Draft EIS, Comment CMA-106, pp. 5.8-65—5.8-67.

[210] FEIS Vol. IV: Responses to Comments on the Draft EIS, pp. 5.8-67 (underlining added for emphasis). http://www.millenniumbulkeiswa.gov/assets/01-volume-iv-appendix-b-introduction-and-federal-agencies22.pdf

211 Cloud Peak Energy, Q4 2016 Results-Earnings Call Transcript. Seeking Alpha, February 15, 2017. https://seekingalpha.com/article/4046500-cloud-peak-energys-cld-ceo-colin-marshall-q4-2016-results-earnings-call-transcript?part=single

212 Shorter term, coal use is substantially constrained by configuration and operating practices at existing power plants. To the extent that is feasible to use coal with varying characteristics and prices, potential savings (notably from using coal that is lower price and thus typically lower quality) may be offset by potential costs (including from lower efficiency (notably higher heat rate requiring more coal/thermal input per unit of electricity output), higher costs for non-fuel O&M (operations and maintenance), higher emissions, and operational problems (including outages and compliance with permits)).

Longer term, based on pricing and other considerations:

- existing power plants can be modified to use coal with characteristics widely different from current usage, but this may require major changes to configuration and operations that may be not be cost-effective (or even feasible), given large potential costs (including capital and O&M costs, outages, emissions, and operational problems); and
- new coal plants may be added to use coal that is estimated to be available and cost-effective.

To provide a better match with power plant requirements, coal with varying characteristics are sometimes blended (typically at or near the power plant). See also endnote 215.

213 See Section 7.6 for additional information on evolving coal pricing and market conditions.

214 See NEPA DEIS, p. 2-7.

215 Boiler slag is the molten bottom ash produced in wet bottom boilers. Markets for high sodium coal include:

High-sodium plants: Some power plants are configured and operated to mitigate the problems associated with high-sodium coal; and

Blending: High-sodium coal can be blended with lower-sodium coal to provide a feedstock usable by a wider range of power plants (notably those not specially configured and operated to use high-sodium coal). High-sodium plants may also use blending (e.g., to enable use of very high-sodium coal).

See endnote 254 (blending).

USGS Professional Paper 1809 (endnote 47), pp. 5, 193;

John T. Boyd, Powder River Basin Coal Resource and Cost Study, 2011 (endnote 78), pp. 3-2, 3-13, 4-8, 5-8, 5-11, Table 4.1;

Tongue River Railroad DEIS, April 2015, Appendix C, Att. A (pdf pp. 381-389). https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf;

Synapse Energy Economics, Declining Markets for Montana Coal, Prepared for the Northern Plains Resource Council, March 1, 2013, pp. 2-5, 18, 26 http://www.synapse-energy.com/sites/default/files/SynapseReport.2013-03.NPRC_.Declining-Markets-for-Montana-Coal.13-022.pdf;

Power Engineering, Four Boiler Contaminants that Jeopardize Power Plant Operation and Maintenance, February 14, 2014 https://www.power-eng.com/articles/print/volume-118/issue-2/abma-special-section/four-boiler-contaminants-that-jeopardize-power-plant-operation-and-maintenance.html;

R. W. Borio and A. A. Levasseur, “Overview of Coal Ash Deposition in Boilers,” Argonne National Laboratory https://web.anl.gov/PCS/acsfuel/preprint%20archive/Files/29_4_PHILADELPHIA_08-84_0193.pdf

[216] Id. Likewise, sodium content is high and an issue for the proposed Otter Creek Mine (discussed in Section 6.3.2.4).

[217] As discussed in Section 7.3, in 2017 disclosures to investors, CPE has also emphasized that US exports to Asia must compete with other lower cost suppliers, notably Indonesia, which is advantaged by proximity and lower transport costs. Given fundamentals, CPE recognizes that the US will never be at the low end of the cost curve for seaborne thermal coal exports.

Cloud Peak Energy, Q4 2016 Results-Earnings Call Transcript, Seeking Alpha, February 15, 2017. https://seekingalpha.com/article/4046500-cloud-peak-energys-cld-ceo-colin-marshall-q4-2016-results-earnings-call-transcript?part=single

[218] Cloud Peak Energy Inc., 2017 Annual Report, Form 10-K, p. 24 https://www.sec.gov/Archives/edgar/data/1441849/000110465918010090/a18-1077_110k.htm

[219] Peabody Energy Corp., 2017 Annual Report, Form 10-K, p. 28. https://www.sec.gov/Archives/edgar/data/1064728/000106472818000007/btu_20171231-10k.htm

[220] Arch Coal, Inc., 2017 Annual Report, Form 10-K, p. 39
https://www.sec.gov/Archives/edgar/data/1037676/000162828018002109/aci-20171231x10k.htm

[221] https://www.platts.com.es/latest-news/coal/houston/us-coal-export-terminal-delay-could-benefit-producers-21310493

[222] This estimate of transportation costs ($53 per metric ton) was provided in late 2015, when transport costs were reduced by low fuel costs and surplus capacity in ocean shipping. The FEIS Coal Market Analysis estimates total transportation cost to Asia would be around $59 per metric ton ($53.53 per ton) for Montana coal to Japan via Millennium. FEIS, SEPA Coal Market Assessment Technical Report, p. 2-17.

[223] Arch Coal's CEO, Q1 2014 Results - Earnings Call Transcript. Seeking Alpha, April 22, 2014 https://seekingalpha.com/article/2154673-arch-coals-ceo-discusses-q1-2014-results-earnings-call-transcript?part=single

[224] See Section 1.5.5 for a discussion on the use of projections from IEA (particularly WEO 2017 and Coal 2017) and EIA projections (particularly AEO 2018) in this report.

[225] Figure 5.4 from WEO 2017 is provided as Figure 16 in this report.

[226] IEA WEO 2017, pp. 215-216 (underlining added for emphasis).

[227] See endnote 370.

[228] This endnote provides sources for the entire paragraph. Mtce is a measure of heat content, rather than weight (mass). For various types of coal, there is typically more than 1 MMTPY per 1 Mtce. See Section 3.3 and specifically endnote 12. For various import markets, thermal coal imports typically comprise over 70% of the total, but metallurgical coal imports are expected to be a somewhat larger share of the total in the future. IEA WEO, p. 216.

[229] Figure 17 reports data for European Union; Figure 19 reports data for all of Europe in order to facilitate comparability with other data on imports; European Union comprises about two-thirds of total European coal imports. IEA WEO, p. 216. IEA Coal 2017, pp. 39-40, 134.

[230] See endnotes 324 (South Korea), 333 (Japan), 349 (China), 367 (India), 376 (Southeast Asia and Other), and 396 (Europe) for additional documentation of sources and methodology.

[231] This endnote provides sources for the entire paragraph.

Cloud Peak Energy, Q2 2018 Results-Earnings Call Transcript, Seeking Alpha, July 27, 2018 (underlining added for emphasis) https://seekingalpha.com/article/4191052-cloud-peak-energy-cld-q2-2018-results-earnings-call-transcript?part=single [NB: language in the source transcript is sometimes ambiguous and has below been excerpted for clarity and brevity]

> Vietnam […], we've exported there a few years ago […] if you look on a map […] our customers should be in Korea or in Japan […] Vietnam […] China is further on […] if demand goes up in India, then that would draw Indonesian coal over there […] favoring us into Japan and South Korea. So that's the way international markets always work.
>
> The important thing is not […] the specific countries, is […] there is […] growth there and that they're going to be taking more seaborne thermal coal. […] as long as we can put it on a ship at a reasonable price, […] it should go to the nearest customers, but the important thing is that demand overall is growing.

232 Compared to thermal coal exports via Northwest ports, Indonesia benefits from shorter shipping distances, as well as other logistical advantages (including capability to barge coal from mining areas to coastal areas, where it is transloaded onto ocean vessels). Shipping distances to markets such as Japan and South Korea are more similar for Australia and US exports via Pacific Northwest ports. Nonetheless, Australia benefits from logistical advantages, including higher heat content coal (see endnote 45regarding why higher heat content coals are more likely to be exported) and established, very extensive infrastructure and ocean shipping enabling high volume exports of both thermal and metallurgical coal to numerous Asian markets.

Indonesia and Australia both benefit from capability to export via Capesize vessels, which have lower transport costs compared with the smaller vessels (notably Panamax) for exports via Millennium. According to the NEPA DEIS (pp. 2-8 – 2-13, 2-17 – 2-20), The terminals identified as most comparable to Millennium are in Australia and can all accommodate Capesize vessels. The terminals in Indonesia are less comparable to the Project and closer to destination markets. Nonetheless, about 70% of total Indonesian terminal capacity can accommodate Capesize vessels, with only 30% limited to Panamax vessels.

233 See endnote 211.

234 WEO 2017, pp. 223-224.

235 This endnote provides sources and notes for the entire paragraph.

The US EIA Annual Energy Outlook (AEO) provides long-term energy projections for the US. Hence, AEO focuses on secular trends, rather than cyclical and other shorter-term fluctuations. AEO 2018 (released February 2018) provides projections for multiple scenarios out to 2050. Our review has focused on the period to 2038 (coinciding with the analysis period in the Millennium FEIS); all export data cited herein are from the AEO 2018 Reference Scenario. Total US coal exports would be about 61 MMTPY in 2025, 66 MMTPY in 2035, and 74 MMTPY in 2038. Exports would be mainly metallurgical coal (remaining flat at about 37 MMTPY). US thermal coal exports (to all markets) would be about 22 MMTPY in 2025, 32 MMTPY in 2035, and 36 MMTPY in 2038. AEO 2018 estimates US coal exports based, in part, on estimates of world coal import demand, incorporating the projections in EIA International Energy Outlook (IEO) 2017 (released September 2017).

https://www.eia.gov/todayinenergy/detail.php?id=35572

https://www.eia.gov/outlooks/aeo/index.php

https://www.eia.gov/outlooks/aeo/pdf/appa.pdf especially p. 29

https://www.eia.gov/outlooks/aeo/assumptions/pdf/coal.pdf especially pp. 9-10

https://www.eia.gov/outlooks/aeo/nems/documentation/coal/pdf/m060(2018).pdf

https://www.eia.gov/outlooks/aeo/data/browser/ AEO Data Browser, especially

https://www.eia.gov/outlooks/aeo/data/browser/#/?id=96-AEO2018&region=0-0&cases=ref2018&start=2016&end=2050&f=A&linechart=ref2018-d121317a.16-96-AEO2018~~ref2018-d121317a.40-96-AEO2018~&map=&ctype=linechart&sourcekey=0

https://www.eia.gov/outlooks/aeo/data/browser/#/?id=96-AEO2018&region=0-0&cases=ref2018&start=2016&end=2050&f=A&linechart=ref2018-d121317a.14-96-AEO2018~ref2018-d121317a.15-96-AEO2018~ref2018-d121317a.24-96-AEO2018~ref2018-d121317a.16-96-AEO2018&ctype=linechart&sourcekey=0

https://www.eia.gov/outlooks/archive/ieo17/ IEO 2017, including projections of thermal coal for electric generation by country grouping https://www.eia.gov/outlooks/archive/ieo17/pdf/appf.pdf

236 Id.; https://nma.org/wp-content/uploads/2017/11/data_at_a_glance_2017p.pdf

237 Id.

238 South Africa, Mozambique, and Botswana, which are advantaged by proximity to South Asian markets (notably India).

239 This endnote provides sources and notes for the entire paragraph.

The IEA (International Energy Agency) World Energy Outlook (WEO) provides long-term energy projections for the world (https://www.iea.org/weo2017/). Hence, WEO focuses on secular trends, rather than cyclical and other shorter-term fluctuations. WEO 2017, released November 2017, (https://webstore.iea.org/world-energy-outlook-2017), provides projections for three scenarios out to 2040 (largely coinciding with the analysis period in the Millennium FEIS (to 2038)). Export data cited herein is for the WEO 2017 New Policies Scenario. Total global thermal coal trade would decline from 756 Mtce in 2016 to 721 Mtce in 2040, while metallurgical coal trade would increase from 292 Mtce to 306 Mtce. Total US coal exports would decline from 44 Mtce in 2016, to 37 Mtce in

2025, and 33 Mtce in 2040. As explained below, these exports would be mainly metallurgical coal, and US thermal coal exports (to all markets) would decline from about 18 MMTPY in 2016 to 15 MMTPY in 2025, and 13 MMTPY in 2040. See WEO 2017, pp. 207, 216, and especially p. 203:

> Inter-regional coal trade stands at 1 010 Mtce in 2040, which is just below the level of 1 050 Mtce in 2016. […] US exporters, with relatively high costs, […] see their shipments dropping (-25%)

WEO 2017 projections are for net exports (Mtce), including both thermal and metallurgical coal; TGG has translated these projections into thermal coal exports (MMTPY) using IEA and AEO 2018 data (about 17.5 MMTPY gross exports of thermal coal in 2016, so about 0.4 MMTPY thermal coal exports per 1 Mtce of all exports).

IEA, Coal 2017, Analysis and Forecasts to 2012. https://www.iea.org/coal2017/

https://webstore.iea.org/download/direct/1136?fileName=Coal_Information_2018_Overview.pdf

[240] IEA WEO 2016, p. 231 (underlining added for emphasis). https://webstore.iea.org/world-energy-outlook-2016

[241] Thermal coal exports to India are mainly to India's West Coast (Arabian Sea), rather than to India's East Coast (i.e., Bay of Bengal, which is proximate to supply from India's domestic coal production). Indonesia and South Africa are the main thermal coal exporters to India, with some US supply via East and Gulf Coast ports. Compared with US and Canadian West Coast ports, US East and Gulf Coast ports are more proximate to India, especially for routings via the Suez Canal. IEA Coal Medium-Term Market Report 2016, pp. 28-29; IEA Coal 2017, p. 105; IEA WEO 2017, p. 22; http://www.archcoal.com/customers/ACI_product_guide_2013.pdf pp. 8,13; https://www.coalage.com/transportation-tips/shipping-prb-coal-to-asia-now/; http://www.coalcontroller.gov.in/writereaddata/files/Provisional%20Coal%20Statistics%202015-16.pdf

[242] EIA, Assumptions to AEO 2018: Coal Market Module, especially pp. 8-9. https://www.eia.gov/outlooks/aeo/assumptions/pdf/coal.pdf

[243] See endnotes 208 and 209.

[244] According to WEO 2017, p. 23 (bold in original):

> Four large-scale shifts in the global energy system set the scene for the *World Energy*
>
> *Outlook-2017 (WEO-2017)*:

- **The rapid deployment and falling costs of clean energy technologies;** in 2016, growth in solar PV capacity was larger than for any other form of generation; since 2010, costs of new solar PV have come down by 70%, wind by 25% and battery costs by 40%.
- **The growing electrification of energy;** in 2016, spending by the world's consumers on electricity approached parity with their spending on oil products.
- **The shift to a more services-oriented economy and a cleaner energy mix in China,** the world's largest energy consumer, subject of a detailed focus in this *Outlook*.
- **The resilience of shale gas and tight oil in the United States,** cementing its position as the biggest oil and gas producer in the world even at lower prices.

245 This paragraph provides sources for the entire paragraph. IEA WEO 2017, pp. 227; IEA World Energy Model Documentation, 2017 Version, pp. 13-14, especially:

https://www.iea.org/media/weowebsite/2017/WEM_Documentation_WEO2017.pdf

> International prices for coal […] in the WEM [World Energy Model] reflect the price levels that would be needed to stimulate sufficient investment in supply to meet projected demand. […]
>
> Fossil fuel price paths vary across the scenarios. For example, in the Current Policies Scenario, policies adopted to reduce the use of fossil fuels are limited. This leads to higher demand and, consequently, higher prices […]. Lower energy demand in the Sustainable Development Scenario means that limitations on the production of various types of resources are less significant and there is less need to produce fossil fuels from resources higher up the supply cost curve. As a result, international fossil fuel prices are lower than in the Current Policies and New Policies scenarios.

246 WEO 2017, p. 24 (bold, italics, and color in original).

247 Ibid.

248 WEO 2017, p. 23 (bold in original).

249 WEO, p. 205.

250 According to WEO 2017 (p.40):

> Another uncertainty is the unpredictable boom-and-bust cycles to which parts of the energy sector are subject. […] Attempting to model such cycles over the longer term would not only be challenging, but would also obscure the policy effects that we seek to examine. Instead, our Outlook projections consider an

energy system that finds and retains equilibrium, i.e. it does not try to capture long-term cyclical dynamics. In reality, some markets might remain in disequilibrium for an extended period, e.g. if today's low levels of upstream investment eventually lead to a price spike that then produces a further over-correction and the start of a new cycle, and so on.

[251] Cloud Peak Energy, Investor Presentations:

July 2018, p. 23; https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q218_Investor_Presentation_FINAL.pdf

October 2018, p. 24. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

[252] Coal Facts, $ Prices, Natural Resources Canada (Government of Canada) website https://www.nrcan.gc.ca/energy/facts/coal/20071;

National Coal Council, Advancing U.S. Exports An Assessment of Opportunities to Enhance Exports of U.S. Coal (see Section 7.3.1 and endnote 205), p. 28:

> Seaborne coal markets have experienced numerous cycles over the past 10 years as is typical for most commodities. The primary reason for the volatility has been the emergence of Asia as an economic power, especially China and India. Market cycles have taken a toll on prices and made long-term coal production planning difficult. Additionally, with global climate initiatives, access to capital for needed investments in coal infrastructure has also become more restricted.
>
> Just before the Global Financial Crisis in 2008, thermal seaborne coal prices reached $180 dollars/tonne ($163/ton) FOB vessel but in 2009, prices collapsed to close to $60/tonne ($54/ton). Prices recovered through 2011 but collapsed again to even lower levels through the first half of 2016. At that time, the combined effects of China reducing production through some overt policy measures and a multi-year capital diet for coal producers lead to an increase in seaborne coal demand. Adding to the events were weather-related disruptions in Australia and regulatory changes in India limiting petcoke [footnote 10 in original deleted] supply. Prices have recently rebounded to approximately $100/tonne.

[253] Powder River Basin coal exports price against both benchmarks (Kalimantan and Newcastle), but are reported to usually price against Kalimantan.

Cloud Peak Press Release, Cloud Peak Energy Inc. Announces Results for Third Quarter and First Nine Months of 2018, October 25, 2018 (underlining added for emphasis): https://investor.cloudpeakenergy.com/press-release/earnings/cloud-peak-energy-inc-announces-results-third-quarter-and-first-nine-months-8

> The international thermal Newcastle coal price index during the third quarter remained over $100 per tonne, currently settling around $114 per tonne due to strong demand. During the same period, the Kalimantan 5000 GAR index price, which the Spring Creek Mine coal typically prices against, has declined to under $55 per tonne.

Cloud Peak Energy Inc., Quarterly Report, period ended September 30, 2018, Form 10-Q, p. 11 https://www.sec.gov/Archives/edgar/data/1441849/000110465918063983/a18-18990_110q.htm

> Our Asian delivered shipments are typically priced broadly in line with a number of relevant international coal indices adjusted for energy content and other quality and delivery criteria. These indices have included the Newcastle benchmark price, as published by Global Coal and others, and the Platts Kalimantan 5000.

[254] Shorter term, coal use is substantially constrained by configuration and operating practices at existing power plants. To the extent that is feasible to use coal with varying characteristics and prices, potential savings (notably from using coal that is lower price and thus typically lower quality) may be offset by potential costs (including from lower efficiency (notably higher heat rate requiring more coal/thermal input per unit of electricity output), higher costs for non-fuel O&M (operations and maintenance), higher emissions, and operational problems (including outages and compliance with permits)).

Longer term, based on pricing and other considerations:

- existing power plants can be modified to use coal with characteristics widely different from current usage, but this may require major changes to configuration and operations that may be not be cost-effective (or even feasible), given large potential costs (including capital and O&M costs, outages, emissions, and operational problems); and
- new coal plants may be added to use coal that is estimated to be available and cost-effective.

To provide a better match with power plant requirements, coal with varying characteristics are sometimes blended (typically at or near the power plant). See also endnote 215.

[255] This endnote provides sources for the entire paragraph.

See endnote 253;

FEIS, SEPA Coal Market Assessment Technical Report, p. 3-7—3-8;

https://publications.industry.gov.au/publications/resourcesandenergyquarterlyjune2018/documents/Resources-and-Energy-Quarterly-June-2018.pdf pp. 36, 41;

https://www.rba.gov.au/publications/bulletin/2015/jun/pdf/bu-0615-3.pdf pp. 20-21;

International Coal Trade-The Evolution of a Global Market, IEA, 1998, pp. 41-48 https://www.iea.org/ciab/papers/coaltrade98.pdf

[256] Cloud Peak's Earnings Conference Call on Q3 2018 Results:

https://seekingalpha.com/article/4214716-cloud-peak-energy-inc-cld-ceo-colin-marshall-q3-2018-results-earnings-call-transcript?part=single

See also the transcripts below for earlier discussions of profitability of exports in relation to Asian benchmark prices.

During Cloud Peak's Earnings Conference Call on Q1 2014 Results, CEO, Colin Marshall estimated that CPE needed a Newcastle benchmark coal price of $80-90/tonne in order for exports to Asia to be profitable.

Cloud Peak Energy, Q1 2014 Results - Earnings Call Transcript, Seeking Alpha, April 29, 2014. https://seekingalpha.com/article/2175763-cloud-peak-energys-ceo-discusses-q1-2014-results-earnings-call-transcript?part=single

Neil Mehta - Goldman Sachs

And just on PRB debt backs, what Newcastle price do you need to make it to be -- PRB in the money relative to Asian coal, or is it for Asian customers? Is it north of $90 bucks?

Colin Marshall

No, I think we said before its south of 90 bucks. So it's probably -- it's between $80 and $90 I think and may be $85 is a good a number as any. We think it's below that at the moment and we're benefiting from the hedges we've got on some of the tons to make the sort of wash. So I think it's between that $80 and $90 level that means that we can at least retain our domestic margin at the Spring Creek mine.

During the same call, CFO Michael Barrett, indicated that in the low-price environment of 2014, CPE delivered its committed tonnages but did not seek to make additional export sales, nor incur take-or-pay commitments:

Michael Barrett

For our logistics segment, in the current low price environment, we focused on delivering our committed tonnages, but not seeking to make additional export sales. As a result, we delivered 4 million export tons and did not incur any take or pay obligations. We also focused on mitigating the impact of the falling Newcastle index price. In 2013, the […] Newcastle price averaged $85. In 2014, it averaged $71, a drop of $14 or 16.5%.

During Cloud Peak's Earnings Conference Call on Q4 2014 Results, CFO Michael Barrett further discusses how CPE managed transportation and logistics costs in 2014 to cope with a falling Newcastle index.

Cloud Peak Energy, Q4 2014 Results - Earnings Call Transcript. Seeking Alpha, February 17, 2015. https://seekingalpha.com/article/2924696-cloud-peak-energys-cld-ceo-colin-marshall-on-q4-2014-results-earnings-call-transcript?part=single

Michael Barrett

As you know, our delivered export coal has historically been priced in the range of 60% to 75% of the Newcastle index. As Newcastle has fallen, we have been able to price towards the higher end of this range. At the same time, we have worked with our logistics providers to manage transportation and port costs. With these actions, we have mitigated some of our business sensitivity to the falling Newcastle price.

[257] As will be discussed in Section 8.8.3, thermal coal imports would increase by about 7 MMTPY from the 2016 volumes to 2022. But IEA Coal 2017 (p. 14) cautions that future coal imports are highly uncertain; imports are under pressure in Taiwan, where coal is facing growing social opposition.

[258] IEA, IEA Coal 2017: Analysis and Forecasts to 2022, pp. 107, 134. https://www.iea.org/coal2017/

[259] Andy Roberts, Planned US coal ports: a swift trip from vital to irrelevant. Wood Mackenzie Blog, February 10, 2016 (bold in original, underlining added for emphasis). http://www.woodmac.com/blog/planned-us-coal-ports-a-swift-trip-from-vital-to-irrelevant/

Wood Mackenzie (WoodMac) is a leading consultancy to coal and other energy industry clients, including Ambre (now known as Lighthouse).

[260] Mark Repsher (PA Consulting Group), Jamie Heller, Charlie Mann and Trygve Gaalaas (Hellerworx), The Future of Coal Versus Gas Competition, 2017, p. 32 http://www.paconsulting.com/insights/the-future-of-coal-versus-gas-competition

[261] McKinsey & Company, Metals & Mining Practice, Downsizing the US coal industry: Can a slow-motion train wreck be avoided?, November, 2015. p. 7. http://www.mckinsey.com/~/media/McKinsey/Industries/Metals and Mining/Our Insights/Downsizing the US coal industry/Downsizing the US%20coal industry.ashx

[262] Trela, Nate, "Uncertainty Burns Hot For US Coal," Forbes, March 1, 2017. https://www.forbes.com/sites/mergermarket/2017/03/01/uncertainty-burns-hot-for-us-coal/#12d707eb51ec

[263] This endnote provides sources for the entire paragraph.

Gateway Pacific NEPA EIS Scoping Comments, SSA Marine [Project proponent via its subsidiary Pacific International Terminals], January 21, 2013, Ex. H, p. 30 (pdf p. 124) http://www.millenniumbulkeiswa.gov/comments/MBTL-EIS-0002108-58915.pdf

> As the term implies, dry bulk commodities are voluminous, dry materials. They are
>
> shipped in bulk rather than as containerized cargo.

Gateway Pacific Revised Project Information Document p. 1-5, fn. 1: http://www.co.whatcom.wa.us/DocumentCenter/Home/View/2797

> Dry bulk commodities include forest, agricultural, or mining products that are particulate in nature; are minimally processed, if at all; and are not bagged or wrapped. Dry bulk commodities are mainly transported as shiploads or trainloads, and handled using large-capacity containers or storage pads and dedicated transfer machinery generally incorporating conveyor systems. Dry bulk commodities include, for example, grain, iron ore, salts, coal, and alumina. Bulk commodities are the "raw material" upon which many industrial processes depend.

See also https://www.wartsila.com/docs/default-source/marine-documents/encyclopedia/wartsila-o-marine-encyclopedia.pdf
Dry bulk is also called solid bulk or bulk solid.

[264] See Section 10.4.3.2.1 regarding labor intensity of the Millennium Project. For studies analyzing labor intensity for handling dry bulk and various other types of commodities, see e.g.,

Martin Associates, The Local and Regional Economic Impacts of the Port of Longview, prepared for Port of Longview, 2013, p. 19. http://www.portoflongview.com/DocumentCenter/View/344

Martin Associates, The Local and Regional Economic Impacts of the Port of Vancouver Marine Terminals, prepared for Port of Vancouver, November 10, 2015, p. 20. http://www.portvanusa.com/assets/POV-Marine-Impacts-2015-final.pdf

For reference sources on design of dry bulk terminals, see:

TA van Vianen, Ottjes, JA and Lodewijks, G, Dry Bulk Terminal Characteristics, 2011, Bulk Solids Handling Whitepaper, especially §5.2 - 5.5 http://www.bulk-solids-handling.com/?q=whitepapers/dry-bulk-terminals-characteristics

Teus van Vianen, Simulation-integrated Design of Dry Bulk Terminals, 2015, PhD thesis, Delft University of Technology, especially pp. 62-100

United Nations Conference on Trade and Developments (UNCTAD), Port Development - a handbook for planners in developing countries, 1985, United Nations, especially Chapter VII (Dry Bulk Cargo Terminals) https://repository.tudelft.nl/islandora/object/uuid:b3511e5e-7630-45dd-8461-dae7c8165643/datastream/OBJ/download

[265] See Sections 10.4.2 and 10.4.3.3 for analysis demonstrating the low labor intensity of the Millennium Project.

[266] The FEIS assumes Full Build-Out Operations by 2028, with throughput ramping up from 2020 onwards. FEIS pp. 2-24, 2-26 (Note b). Proposed rail operations and coal export terminal design would support terminal throughput of 40 MMTPY for Stage 2, but Applicant assumes a 10% increase in throughput (4 MMTPY) is possible with rail car capacity increases, through process efficiency and technological improvements by 2028, the first year of assumed full operations.

[267] The FEIS assumes Full Build-Out Operations by 2028, with throughput ramping up from 2020 onwards. FEIS p. 2-24—2-25.

[268] See Sections 4.6 and 4.7 including National Coal Council Coal Exports white paper (endnote 31).

[269] FEIS, pp. 2-6–2-8, 2-29–2-31, 3.1-10; see endnote 274.

[270] This coal is combusted together with biomass to produce steam for process use and electricity generation. Weyerhaeuser previously owned all facilities at the Longview wood products complex and retains ownership of the lumber mill and log export yard. The NORPAC thermomechanical pulp and paper mill is now owned by One Rock Capital Partners, LLC. The NDP kraft pulp and paper mill is owned by Nippon Paper Industries. FEIS, p. 3.1-10;

http://www.nrel.gov/docs/fy04osti/35124.pdf https://fortress.wa.gov/ecy/industrial/UIPermit/ViewDocument.aspx?DocumentId=352 pp. 3, 20, 46, 51.

[271] FEIS, p. 2-7, 2-29.

[272] With current activities, the existing bulk terminal receives 25-30 rail cars of coal per train and 1-2 trains per week. FEIS, Table 2-1, p. 2-8. Annual throughput = 144k to 346k MTPY = 25 to 30 cars*1 to 2 trains per week*52 weeks per year*110.8 metric tons per car (122.1 tons per car). The above calculation assumes 122.1 tons per car and may thus overestimate throughput. This assumption is based on the FEIS estimate for Project-related gondola cars, which would be unloaded at a rotary dumper. FEIS, pp. 2-13–2-14, 5.1-4. The existing bulk terminal unloads coal cars using a gravity fed bin under the rail line. FEIS, p. 2-6. This configuration likely requires the use of hopper cars with bottom outlets; these cars may have a smaller cargo capacity than rotary gondola cars.

[273] The FEIS assumes that the existing bulk terminal will continue operating and possibly expand, separate from and independent of the Project. FEIS, pp. 2-5–2-8, 2-29–2-31; SEPA Vessel Transportation Technical Report pp. 3-14–3-17.

[274] According to the FEIS Table 2-5, Planned Activities and Transport Operations at the Existing Bulk Product Terminal, by 2018 the existing bulk terminal was to receive 38-45 rail cars of coal per train and 3 trains per week. FEIS, p. 2-30. Annual throughput = 656k to 778k MTPY = 38 to 45 cars*3 trains per week*52 weeks per year*110.8 metric tons per car (122.1 tons per car). The above calculation assumes 122.1 tons per car and may thus overestimate throughput. The same assumptions are made regarding the overestimation of the throughput as those described in endnote 272.

According to the FEIS Table 2-6, Potential Future Commodities and Transport Operations at the Expanded Bulk Product Terminal by Year 2028, the existing bulk terminal could receive 38-45 rail cars per train and 2-4 trains per day; any increase from current volumes would be other commodities (fly ash, sand or gravel), rather than coal. FEIS, p. 2-30–2-31.

[275] BST Associates, 2017 Marine Cargo Forecast and Rail Capacity Analysis, prepared for Washington Public Ports Association and Washington State Freight Mobility Strategic Investment Board, August 2017, pp. 59, 63, 90 (quoted below): https://static1.squarespace.com/static/5a8499e518b27dc83c2403ce/t/5af0ba816d2a73731f8d1faa/1525725867212/Marine-Cargo-Forecast-2017-Final-10-2017.pdf

> Coal is not currently exported through terminals in Washington or Oregon. Coal is included in the high forecast, however, and this forecast assumes that the Millennium Bulk Terminal in Longview is constructed and operates at full capacity (44 million metric tons per year). All of the coal would move by rail. To provide a sense of the scale of the potential coal exports, total dry bulk exports

[TGG note: excluding grain] are currently approximately 7.5 million metric tons per year, while current grain exports are 32 million metric tons.

Total dry bulk exports from Lower Columbia River ports (in both Washington and Oregon) were 29.7 MMTPY in 2015, including 23.3 MMTPY of agricultural commodities (grains and oilseeds) and 6.4 MMTPY of other commodities (including potash, soda ash, and petroleum coke). Total dry bulk exports from all Washington ports (plus lower Columbia River ports in Oregon) were 39.4 MMTPY in 2015, including 31.9 MMTPY of grains and oilseeds and 7.5 MMTPY of other commodities. Coal is not currently exported through terminals in Washington (or Oregon). So by itself, the Project would export more dry bulk tonnage than is now exported at all the other ports combined (on the Lower Columbia or even in all of Washington plus lower Columbia River ports in Oregon).

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Notes:

	Data reported by Westshore for a given year is sometimes updated in subsequent reports, and some data in this table is based on this updated.
[1]	Major upgrades that increased capacity were completed in late 2009 and last 2012; it is assumed here that the increased capacity was not fully available until the following year (2010 and 2013). The capacity following the 2009 upgrade was initially estimated as 29 MMT, but was later estimated as 27 MMT, so 27 MMT is assumed here for 2010-2012.
[7], [8], [9]	Coal loading revenues are charges for loading coal onto seagoing vessels. Other revenues (including wharfage fees based upon time a ship is at the terminal) are typically about 3% of total revenues. In 2015 and 2016, other revenues were much higher, due to buyout payments (from US coal producers restructuring contracts to reduce volume commitments), and shortfall payments (under take or pay contracts where the coal had not been shipped). In effect, producers paid reservation fees, to avoid exporting coal at a loss into weak markets.
[12], [14],[15]	Operating and Administrative Expenses reported by Westshore include Depreciation starting in 2010.
[13]	Not specifically reported by Westshore, so calculated as [14]-[10]-[11]-[12].

Sources:
Environmental Impact Assessment:
Westshore Terminal Equipment Replacement and Upgrade Project, November 2013
http://www.portvancouver.com/wp-content/uploads/2015/03/here1.pdf
Westshore Terminals Income Fund, Annual Reports, 2007-2009, March 2008 - 2010
Westshore Terminals Investment Corporation, Annual Reports, 2010-2017, March 2011 - 2018
Westshore Terminals Income Fund, Annual Information Forms, March 2008 - 2010
Westshore Terminals Investment Corporation, Annual Information Forms, March 2011 - 2018
Available: SEDAR database http://www.sedar.com/search/search_form_pc_en.htm
Also available: Westshore Terminals website
Annual Reports

http://www.westshore.com/pdf/finance/2010/ar.pdf
http://www.westshore.com/pdf/finance/2011/ar.pdf
http://www.westshore.com/pdf/finance/2012/ar.pdf
http://www.westshore.com/pdf/finance/2013/ar.pdf
http://www.westshore.com/pdf/finance/2014/ar.pdf
http://www.westshore.com/pdf/finance/2015/ar.pdf
http://www.westshore.com/pdf/finance/2017/ar.pdf
http://www.westshore.com/pdf/finance/2018/ar.pdf

Annual Information Forms

http://www.westshore.com/pdf/finance/2010/aif.pdf
http://www.westshore.com/pdf/finance/2011/aif.pdf
http://www.westshore.com/pdf/finance/2012/aif.pdf
http://www.westshore.com/pdf/finance/2013/aif.pdf
http://www.westshore.com/pdf/finance/2014/aif.pdf
http://www.westshore.com/pdf/finance/2015/aif.pdf
http://www.westshore.com/pdf/finance/2017/aif.pdf
http://www.westshore.com/pdf/finance/2018/aif.pdf

NB: Data originally provided by Westshore is sometimes revised in subsequent reports, and some data in this table based on these revisions.

Exchange Rates CAD/USD (Bank of Canada)
https://www.bankofcanada.ca/rates/exchange/
https://www.bankofcanada.ca/valet/observations/group/LEGACY_ANNUAL_RATES/csv
https://www.bankofcanada.ca/valet/observations/group/FX_RATES_ANNUAL/csv?start_date=2017-01-01

	2010	2011	2012	2013	2014	2015	2016	2017
CAD per USD	1.02994	0.98907	0.99958	1.02991	1.10447	1.27871	1.32481	1.29860
USD per CAD	0.97093	1.01105	1.00042	0.97095	0.90541	0.78204	0.75483	0.77006

[277] Western Canadian metallurgical coal production is mainly in southeastern BC, and secondarily in Alberta.

[278] Westshore AIF (March 2017)

http://www.westshore.com/pdf/finance/2017/aif.pdf p. 6

[279] http://www.westshore.com/pdf/finance/2017/aif.pdf pp. 2, 7-8

[280] Tongue River Railroad DEIS, April 2015, Appendix C, pp. C.2-6—C.2-7 (pdf pp. 55-56), and Chapter 4 (pp. 4.1-4.12 (pdf pp. 109-120)

https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

281 Westshore Berth 1 has a depth of 75 feet and can handle ships up to 260,000 deadweight tonnes. Berth 2 has a depth of 68 feet and can handle ships up to 180,000 deadweight tonnes. Capesize vessels could also have been accommodated at the Gateway Pacific Coal Export Terminal (proposed project, application withdrawn February 7, 2017, located in Cherry Point, Washington, about 22 miles southeast of Westshore).

http://www.westshore.com/pdf/finance/2017/aif.pdf p.7;

http://www.ecy.wa.gov/geographic/gatewaypacific/20141104-GPT-VesselTrafficRiskAssessment-Glosten.pdf; FEIS p. 6-9.

282 The FEIS assumes that rail distance to the Project is about 125 miles shorter than to Westshore, and that rail costs to the Project are about $3/ton lower (2012$). SEPA Coal Market Assessment Technical Report p. 2-16.

283 Westshore can currently accommodate longer (150-plus car) unit trains. The Project would use shorter (125 car) unit trains. FEIS p. 2-27; SEPA Rail Transportation Technical Report pp. 2-2, 2-4.

284 https://www.portvancouver.com/development-and-permits/development/roberts-bank-rail-corridor/

285 http://www.westshore.com/pdf/finance/2015/aif.pdf p. 8

> Some of the rail carriers are increasing train length to 152 cars, and Westshore has successfully handled a substantial number of these longer trains.

BNSF serves Westshore (and would also be the main rail carrier for the Millennium Project). Since 2006, BNSF has been using longer (150 car) coal unit trains for some movements.

T.C. Whiteside and G.W. Fauth III, Heavy Traffic Still Ahead, Western Organization of Resource Councils, February 2014, p. 23
http://heavytrafficahead.org/pdf/Heavy-Traffic-Still-Ahead-web.pdf

http://www.bnsf.com/ship-with-bnsf/ways-of-shipping/dedicated-train-service.html#subtabs-1

286 Environmental Impact Assessment: Westshore Terminal Equipment Replacement and Upgrade Project, November 2013 http://www.portvancouver.com/wp-content/uploads/2015/03/here1.pdf

Engagement Summary Report: Westshore Terminals Equipment Replacement and Upgrade Project, December 2013, especially p. 14 http://www.portvancouver.com/wp-content/uploads/2015/03/westshore-terminals-engagement-summary-report-december-30-2013-final.pdf

287 FEIS pp. 2-26 – 2-27.

288 NEPA DEIS pp. 2-9 – 2-13, 2-17 – 2-20; http://www.ecy.wa.gov/geographic/gatewaypacific/20141104-GPT-VesselTrafficRiskAssessment-Glosten.pdf

289 See endnote 281.

290 NEPA DEIS pp. 2-9 – 2-13, 2-17 – 2-20. The terminals identified as most comparable to the Project are in Australia and can all accommodate Capesize vessels. The terminals in Indonesia are less comparable to the Project and closer to destination markets. Nonetheless, about 70% of total Indonesian terminal capacity can accommodate Capesize vessels, with only 30% limited to Panamax vessels.

291 SEPA Coal Market Assessment Technical Report, p. 2-16.

292 http://www.ecy.wa.gov/geographic/gatewaypacific/20141104-GPT-VesselTrafficRiskAssessment-Glosten.pdf

293 FEIS, pp. p. S-33, 2-24, 2-26, 5.4-35–5.4-36.

294 See endnote 314. In the first nine months of 2017 and 2018, Cloud Peak Energy exported 7.4 MMst of thermal coal from Montana Spring Creek Mine loaded onto 54 ships, averaging over 137,000 tons per ship (over 124,000 metric tons per ship). This tonnage per ship is similar to, albeit a bit higher, than the overall average at Westshore. See Table 5. Westshore has handled 195-300 ships per year and throughput 20-31 MTPY, so an average cargo size of about 100,000 metric tons per ship in earlier years and 110,000 metric tons per ship in recent years. There has been a long-term upward trend in cargo size at Westshore, so the advantage of Westshore in terms of larger ships relative to the Project may continue to increase.

Environmental Impact Assessment: Westshore Terminal Equipment Replacement and Upgrade Project, November 2013 http://www.portvancouver.com/wp-content/uploads/2015/03/here1.pdf

Engagement Summary Report: Westshore Terminals Equipment Replacement and Upgrade Project, December 2013, especially p. 14 http://www.portvancouver.com/wp-content/uploads/2015/03/westshore-terminals-engagement-summary-report-december-30-2013-final.pdf

Worley Parsons Canada. 2011, Projections of Vessel Calls and Movements at Deltaport and Westshore Terminals: Deltaport Terminal Road and Rail Improvement Project

(DTRRIP). Report No. 09409-04-GE-90003-500- Rev B. Prepared for Port of Metro Vancouver. 28 November 2011. http://www.robertsbankterminal2.com/wp-content/uploads/Projections-of-Vessel-Calls-and-Movements-at-Deltaport-and-Westshore-Terminals.pdf

295 The FEIS estimates rail costs for export via Westshore are about $3/ton (2012$/short ton) higher than via the Project. SEPA Coal Market Assessment Technical Report, p. 2-16. Ocean shipping costs from Westshore to Asia via Capesize vessels might be in the order of $2-3/ton less expensive than via Panamax, but this differential could vary based on market conditions and other factors.

https://www.eia.gov/outlooks/aeo/nems/documentation/coal/pdf/m060(2018).pdf p. 1

https://www.platts.com/IM.Platts.Content/ProductsServices/Products/coaltraderintl.pdf

296 See endnote 189.

297 Cloud Peak Energy, Press Release: "Cloud Peak Energy Modifies Throughput and Transportation Agreements with Westshore Terminals and BNSF Railway," February 15, 2017: https://investor.cloudpeakenergy.com/press-release/corporate/cloud-peak-energy-modifies-throughput-and-transportation-agreements-westshor

> Cloud Peak Energy Inc. […], one of the largest U.S. coal producers and the only pure-play Powder River Basin ("PRB") coal company, today announced that Cloud Peak Energy Logistics LLC replaced its throughput agreement with Westshore Terminals Limited Partnership […] and its transportation agreement with BNSF Railway Company ("BNSF").
>
> Under the new agreements, which are effective commencing January 2017 for the throughput agreement and April 2017 for the transportation agreement, Cloud Peak Energy made upfront payments and also committed to minimum payments through 2018. The outstanding undiscounted commitments are approximately $51 million through the current two year term of these agreements.
>
> Both agreements provide that the parties may extend the agreements through the end of 2019 if elected. In addition, Westshore has certain priority rights on throughput capacity in respect of any export shipments by Cloud Peak Energy through 2024. The original throughput and transportation agreements and underlying take-or-pay commitments, which have now been replaced, previously would have expired at the end of 2024.

"Westshore and BNSF are critical parts of our effort to maintain a viable long-term Asian export business. We value our strong relationships with Westshore and BNSF and appreciate their willingness to work with us. We believe in the long-term opportunity for

Asian exports of Powder River Basin coal," said Colin Marshall, Cloud Peak Energy's President and Chief Executive Officer.

298 Westshore Terminals, 2017 Annual Information Form, March p. 9. (bold in original; underlining added for emphasis)

http://www.westshore.com/pdf/finance/2017/aif.pdf

299 In 2015 and 2016, Westshore other revenues totaled more than CAD$83 million, compared with CAD$9 million or less per year previously. On this basis, the other revenues due to reservation fees were in the order of CAD$65 million (about USD$50 million).

300 Take-or-pay contracts require that the buyer either take the product from the supplier, or pay the supplier for product not taken. Take-or-pay contracts are common in the energy/utilities/commodities sectors (including natural gas, electricity, oil, water, mining and metals). These sectors have sizeable fixed costs (relating to capital and some other costs, notably for facilities with long lead times and long lifetimes). Take-or-pay contracts guarantee a minimum level of revenues and enable financing for suppliers and facilities with sizeable fixed costs.

301 This endnote provides sources and notes for all of Section 7.7.4.

Table 2; SEPA Coal Market Assessment Technical Report, pp. 2-12-2-15; Tongue River Railroad DEIS, April 2015, Appendix C, pp. C.2-6—C.2-7 (pdf pp. 55-56), and Chapter 4 (pp. 4.1-4.12 (pdf pp. 109-120)

https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

Ridley Terminals website http://www.rti.ca/

Including map showing Ridley is connected with PRB production http://www.rti.ca/sites/default/files/shippingcommodities.png

Neptune Terminals website http://www.neptuneterminals.com/

Westshore Terminals Investment Corporation, Annual Report, March 21, 2018, p 6 (emphasis bold in original): http://www.westshore.com/pdf/finance/2018/aif.pdf

> Ridley operates a single-berth coal loading facility in Prince Rupert, approximately 1,500 kilometres north of Vancouver. This facility was built specifically to serve British Columbia's northeast coalfields, then consisting of the Quintette and Bullmoose mines. Ridley's business was sourced primarily

from those mines, both of which closed by early 2003. Commencing in 2004 new mines opened in Northeastern British Columbia and Ridley's throughput increased significantly, reaching 12 million tonnes in 2013. Ridley had experienced reduced volumes since 2014 because of mines being idled or shut down, and bankruptcies of coal companies in the area, due to lower coal prices. In 2017, Ridley handled approximately 7.6 million tonnes, up from recent prior years as one of its prior mine customers re-opened during the year. It reports that it has an overall annual throughput capacity of 18 million tonnes.

Neptune operates a three-berth terminal operation that handles various bulk commodities including coal, potash and fertilizer. Located in Vancouver's inner harbour on land leased from VFPA, Neptune is owned by its shippers, including Teck which holds a 46% interest and ships coal through Neptune. Teck has made additional investments in Neptune designed to increase its coal-handling capacity to 12.5 mpta. Neptune has planned and obtained the permits required for execution of a project to expand its coal handling capacity by approximately 50%. Teck announced on February 14, 2018, that it will make expenditures of $85 million in 2018 to commence work on this expansion.

Annual export shipments (in millions of tonnes) through Westshore, and through Neptune and Ridley, for the last ten years were as follows:

Loading Contracts

Westshore generally operates under long-term contracts with its customers. Westshore's agreement with Teck extends to March 31, 2021 and commits Teck to ship 19 million tonnes per contract year at fixed rates. Westshore expects that Teck will ship most of the remaining coal from its mines through Neptune. Teck announced on February 14, 2018 plans to spend $85 million during the year to increase capacity at Neptune.

Westshore's contracts with U.S. thermal coal producers have different expiry dates. Its agreement with Cloud Peak Energy Inc. ("Cloud Peak") expires at the end of 2020 and its other agreements with U.S. thermal coal producers extend beyond 2020. The current agreement with Cloud Peak requires minimum payments in each year of the contract. Under its contract, Global Sales Group, LLC must ship a minimum annual volume each year, with the option to increase such annual volume within prescribed amounts at fixed rates with the potential for increases to the rate based on the price of coal achieved by the customer.

In 2016, Westshore entered into a long-term shipping contract with LHR Coal Marketing, LLC (“Lighthouse”), a U.S. thermal coal producer. Pursuant to this agreement, Lighthouse is required to ship minimum volumes in 2017 and 2018, with an option to increase such volumes within prescribed amounts, and provides for fixed shipment volumes at fixed rates thereafter.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Westshore(1)	21.1	20.1	24.7	27.3	26.1	30.1	30.6	28.8	25.8	29.0
Neptune	4.8	4.3	5.5	5.2	6.4	7.5	7.5	6.3	7.4	7.6
Ridley(1)	4.8	4.0	8.1	9.6	11.5	12.1	7.2	4.4	4.0	7.6
Total	**30.7**	**28.4**	**38.3**	**42.1**	**44.0**	**49.7**	**45.3**	**39.5**	**37.2**	**44.2**

NOTE:

(1) Includes petroleum coke.

302 http://westmoreland.com/wp-content/uploads/2014/08/News402_Cloud-Peak-Ridley-08-08-14.pdf See also Section 6.4.3 and endnote 109.

303 This endnote provides sources and notes for all of Section 7.7.4.

Tongue River Railroad DEIS, April 2015, Appendix C, pp. C.2-6—C.2-7 (pdf pp. 55-56), and Chapter 4 (pp. 4.1-4.12 (pdf pp. 109-120)

https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

https://www.coalage.com/transportation-tips/shipping-prb-coal-to-asia-now/

- Gulf Coast an option for PRB coal to India, and routing through Suez Canal much shorter than around Cape (add to discussion elsewhere on ports for exports to India)
- using existing logistics and Inland barge to facilitate movement of PRB coal to Gulf Coast
- Gambrel article was cited and referred to in NEPA DEIS for Millennium.

Arch Coal 2013 Product Guide showing multiple port alternatives on East, Gulf, and West Coasts: http://www.archcoal.com/customers/ACI_product_guide_2013.pdf

304 http://ambreenergy.com.au/wp-content/uploads/2015/08/annualreport2011_ae_webversion_final.pdf pp.7-8, 10, 20

(bold in original); see also p. 13: map shows Black Butte mine connected by rail line to Port of Corpus Christi Texas (US) Lease site for proposed coal export terminal, as well as to Millennium and Port of Morrow. While not specified there, this rail line would be (most if not all) via UP. Map also shows Decker Mine and rail line to Millennium and Port of Morrow. While not specified there, this rail line would be (most if not all) via BNSF.

305

http://portofcc.com/images/pccpdfs/Agenda/2013_12_10/Dec%2010%20BOARDBOOK.pdf p. 183

306 This endnote provides sources and notes for all of Section 7.7.4.

Montana Signal Peak Mine has exported to Europe via Great Lakes and Quebec.

Tongue River Railroad DEIS, April 2015, Appendix C, pp. C.2-6—C.2-7 (pdf pp. 55-56), and Chapter 4 (pp. 4.1-4.12 (pdf pp. 109-120)

https://www.stb.gov/decisions/readingroom.nsf/WebDecisionID/44400?OpenDocument

https://www.stb.gov/decisions/readingroom.nsf/UNID/E7DE39D1F6FD4A9A85257E2A0049104D/$file/AppC_CoalProduction.pdf

Lamberts Point (Pier 6), Norfolk, Virginia

The largest existing North American coal terminal is Lamberts Point (Pier 6) in Norfolk, VA. The capacity of this terminal is a throughput of 34.5 MMTPY; actual throughput has typically been much lower.[306]

Lamberts Point typically handles only small volumes of thermal coal (less than 15% of total shipments). This terminal specializes in and mainly handles metallurgical coal. It is proximate to Eastern US (Appalachian) metallurgical coal production and a large number of mines. Coal is transported to the terminal by Norfolk Southern, the railroad which owns and operates the terminal. The mines supplying coal to Lamberts Point are mainly in Central Appalachia (CAPP) and Northern Appalachia (NAPP).

Lamberts Point has a unique configuration that enables blending of coal from different sources to precise formulas as it is being loaded onto ships. Custom blending is a valuable service to metallurgical coal users, which have very specific blend requirements and can receive the coal ready to use off the ship.

At Lamberts Point, coal remains in the arriving rail hopper cars, and it is stored there on-site until dumped into a conveyor system, which feeds directly into ships' holds. At other terminals (including the Millennium Project), coal is dumped from arriving rail cars and stored on-site in large open stockpiles. Aside from enabling precise custom blending, the configuration at Lamberts Point also has benefits in terms of avoiding large open stockpiles, where coal is subject to quality degradation, degassing, oxidation, and spontaneous combustion.

http://www.powermag.com/fire-protection-guidelines-for-handling-and-storing-prb-coal/?printmode=1

http://krtcommodities.com/files/PRB%20COAL%20DEGRADATION.pdf

https://www.gewater.com/kcpguest/documents/Case%20Studies.../CS1433EN.pdf

http://www.powermag.com/who-moved-my-btus-the-pitfalls-of-extended-coal-storage/?printmode=1

http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0019/420481/MDG-28-Safety-requirements-for-coal-stockpiles-and-reclaim-tunnels.pdf especially pp. 14-15, 23

https://www.usea.org/sites/default/files/media/Assessing%20and%20managing%20spontaneous%20combustion%20of%20coal%20-%20ccc259_new.pdf

https://www.usea.org/sites/default/files/092013_Quantifying%20emissions%20from%20spontaneous%20combustion_ccc224.pdf

http://www.iea-coal.org.uk/documents/83117/8683/Gaseous-emissions-from-coal-stockpiles,-CCC/213

Lamberts Point has deepwater access and can accommodate Capesize vessels.

Both loading berths and the lay berth have a 50-foot draft. Lamberts Point has loaded Capesize ships with metallurgical coal cargoes exceeding 153,000 metric tons (168,000 tons).

http://www.nscorp.com/content/nscorp/en/news/blowing-past-its-own-records-norfolk-southerns-pier-without-peer-sets-new-us-coal-transload-benchmark.html

http://www.nscorp.com/content/nscorp/en/news/Norfolk-Southern-coal-vessel-loading-is-Virginias-largest-Period.html

Norfolk Southern, “Norfolk Southern celebrates 50 years of world-class service to global coal market with Pier 6,” News Release, September 18, 2013 http://www.nscorp.com/content/nscorp/en/news/Norfolk-Southern-celebrates-50-years-of-world-class-service-to-global-coal-market-with-Pier-6.html

Norfolk Southern (2007a), Lamberts Point Coal Terminal, Norfolk, Va., website accessed June 5, 2017
http://www.nscorp.com/content/nscorp/en/shipping-options/coal/transload-facilities/lamberts-point-coal-terminal-norfolk-va.html

Norfolk Southern (2007b), Coal, Coke & Iron Ore Publications, NS 4007-F Lamberts Point, Coal Business Group - Loading Status (XLS), website accessed June 6, 2017
http://www.nscorp.com/content/nscorp/en/transportation-terms/other-requirements/coal-coke-and-iron-ore-publications.html
http://www.nscorp.com/content/dam/nscorp/ship/shipping-tools/LoadingStatusListing.xls

Arch Coal 2013 Product Guide showing multiple port alternatives on East, Gulf, and West Coasts: http://www.archcoal.com/customers/ACI_product_guide_2013.pdf

307 See endnotes 324 (South Korea), 333 (Japan), 349 (China), 367 (India), 376 (Southeast Asia and Other) and 396 (Europe) for additional documentation of sources and methodology.

308 See discussion of other developing Asia in Section 8.3.4, and endnote 370 for the detailed list of countries included in other developing Asia.

309 Complaint, ¶¶24-34, 45-48.

310 Id., ¶48.

311 The endnote provides sources for the entire paragraph. See Section 7.5.1 and specifically Figure 18-Figure 22. See also FEIS, SEPA Coal Market Assessment Technical Report, 3-1 - 3-6; the SEPA Coal Market Assessment focuses on South Korea, Japan, Taiwan, and China as potential markets for exports via Millennium. The Complaint (¶34) mentions China, but not as a coal importer:

> Japan, South Korea, and other U.S. allies in Asia want stable and secure energy supplies for their economies and stability in the region, especially in light of the threat from North Korea and the growing international activism of China and the Russian Federation.

312 There are many differences between various top coal-importing Asian markets but a key distinction is that South Korea, Japan, and Taiwan have little if any domestic coal production, so they import all or virtually all of their coal supply. China and India import coal to supplement supply from large domestic coal production. Perhaps a useful and parallel way to express this is that imports are swing supply to China and India and are thus volatile and uncertain. And that makes US exports doubly volatile and uncertain in that US is a swing supplier to imports which are swing supply to China and India.

313 http://www.lighthouseresourcesinc.com/decker-mine/

[314] Cloud Peak Energy Inc., 2017 Annual Report, Form 10-K, pp. 3-4 https://www.sec.gov/Archives/edgar/data/1441849/000110465918010090/a18-1077_110k.htm;

> Spring Creek Mine's location and the high Btu content of its coal make its coal better suited than our other coal for export […]
>
> The location of the Spring Creek Mine also provides access to export terminals in the Pacific Northwest, providing a geographic advantage relative to other PRB mines. During the years ended December 31, 2017, 2016, and 2015, we shipped approximately 4.2, 0.6, and 3.6 million tons, respectively, of Spring Creek coal through the Westshore terminal located in British Columbia, Canada.

Cloud Peak Energy Inc., SEC Form 10-Q, October 25, 2018, for the quarterly period ended September 30, 2018, p. 59 https://www.sec.gov/Archives/edgar/data/1441849/000110465918063983/a18-18990_110q.htm.

> We shipped 31 vessels and a total of 4.1 million tons internationally in the first nine months of 2018 compared to 3.3 million tons on 23 vessels in the first nine months of 2017.

See also Cloud Peak Energy Investor Presentations:

March 2014, p. 28; https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Updated_YE13_Investor_Presentation_FINAL.pdf

October 2018, p. 11. https://investor.cloudpeakenergy.com/sites/cldpk.investorhq.businesswire.com/files/doc_library/file/Q318_Investor_Presentation_FINAL.pdf

[315] FEIS Vol. IV: Comments on the Draft EIS, General Public Part 2, Cloud Peak Energy, June 10, 2016 (Comment 2447), pdf p. 310. (Underlining added for emphasis). http://www.millenniumbulkeiswa.gov/assets/07-volume-iv-appendix-b-general-public-part-22.pdf

[316] See also endnote 312

[317] Sources and detailed derivation of these projections are provided in Section 8.4.2 and corresponding endnote.

[318] IEA WEO 2017, p. 46 (bold in original).

[319] Id., p. 226 (bold in original, underlining added for emphasis).

320 IEA Coal 2017: Analysis and Forecasts to 2022, p. 107. https://www.iea.org/coal2017/

321 Id., p. 77.

322 Id. (underlining added for emphasis).

323 Within the 2016 to 2022 period, Coal 2017 projects that thermal coal imports will initially increase and then decline, such that volumes in 2020 and onward are lower than in 2016. IEA Coal 2017, p. 134.

324 This endnote provides sources and notes for the entire paragraph.

IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- If thermal coal imports decline at the same rate as all imports, 46 MMTPY (change in thermal coal imports) = 54 Mtce (change in all [thermal + metallurgical] coal imports) * 0.85 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports);
- 54 Mtce (change in all coal imports). IEA WEO 2017, Figure 5.9 (provided in this report as Figure 17) data download www.iea.org/weo/weo2017secure/
- 0.85 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) = South Korea Scalar in 2016 = 100 MMTPY Thermal Coal Imports/117 Mtce. IEA Coal 2017, pp. 39, 134; IEA WEO 2017, p. 226. For import markets where data are reported for both Mtce and MMTPY, scalars are typically 0.8 to 1.0. For South Korea, actual imports in 2016 include a large component of metallurgical coal and would thus typically have a Scalar towards the lower end of this range. See endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions.
- If thermal coal imports comprise the entire decline in all imports (metallurgical coal imports are flat), 65 MMTPY (change in thermal coal imports, from 2016 to 2040) = 54 Mtce (decrease in South Korea thermal coal imports, from 2016 to 2040) * 1.20 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports);
- 1.20 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports) = South Korea Thermal Content Scalar in 2016 = 100 MMTPY Thermal Coal Imports/ 83 Mtce. IEA Coal 2017, pp. 39, 134; IEA WEO 2017, p. 226.
- If thermal coal imports decline by 55% from 2016 to 2040 (the average of the above two estimates projecting a decline of 46 MMTPY and 65 MMTPY, respectively): 55 MMTPY (change in thermal coal imports, from 2016 to 2040) = 46 Mtce (decrease in

South Korea thermal coal imports, from 2016 to 2040) * 1.20 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports).

- The validity of the above analysis and estimate (55 MMTPY change in South Korea thermal coal imports, from 2016 to 2040) is confirmed by alternative analysis (described below) resulting in a virtually identical estimate (54 MMTPY change in South Korea thermal coal imports, from 2016 to 2040);
- 54 MMTPY (change in thermal coal imports) = 54 Mtce (change in all [thermal + metallurgical] coal imports) * 1.0 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports). In this scenario, the projected decrease in all exports includes only a small component of metallurgical coal and would thus have a Scalar at (or above) the high end of the typical range (0.8 to 1.0).

325 Even if all imports (including thermal and metallurgical coal) drop by the amount projected by IEA WEO 2017, thermal coal may drop by more (and metallurgical coal by less). For example, IEA Coal 2017 (p. 134) projects that South Korea metallurgical coal imports will increase by 1.8% per year, from 34 Mtce in 2016 to 37 Mtce in 2022, while thermal coal imports are projected to fall by 1.2% per year, from 117 Mtce in 2016 to 108 Mtce in 2022 See Section 9.3.2.1 and 8.8.2.4 and endnotes 324, 333, 349, 367, 376, 387, and 396, and for additional information and analysis regarding relationships between steel production, metallurgical coal, and imports in Asian countries/regions (notably South Korea, China, India, and other developing Asia) and Europe.

326 See also Section 9, which identifies and responds to Lighthouse Complaint Claims on South Korea.

327 EIA Country Analysis Brief: South Korea, July 2018, p. 15. https://www.eia.gov/beta/international/analysis_includes/countries_long/Korea_South/south_korea.pdf;

Buckley, Tim and Nicholas Simon, Bylong Coal Project Expert Review, Institute for Energy Economics and Financial Analysis, June 2018, pp. 6-7. http://ieefa.org/wp-content/uploads/2018/06/Bylong-Coal-Project-Expert-Review_June-2018.pdf

328 Sources and detailed derivation of these projections are provided in Section 8.5.2.2 and corresponding endnote.

329 IEA WEO 2017, p. 226 (bold in original). (bold in original, underlining added for emphasis).

330 Id. p. 107 (underlining added for emphasis).

331 IEA Coal 2017, p. 134.

332 31% = 52 Mtce (change in all coal imports, from 2016 to 2040)/168 Mtce (all coal imports in 2016). See endnote 333 and IEA WEO 2017, p. 216 (cited therein).

333 IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- 43 MMTPY (change in thermal coal imports) = 52 Mtce (change in all [thermal + metallurgical] coal imports) * 0.82 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports);
- 52 Mtce (change in all coal imports). IEA WEO 2017, p. 216 and Figure 5.9 (provided in this report as Figure 17) data download www.iea.org/weo/weo2017secure/;
- 0.82 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) = Japan Scalar in 2016 = 138 MMTPY Thermal Coal Imports/168 Mtce. IEA Coal 2017, pp. 39, 134; IEA WEO 2017, pp. 216, 226. For import markets where data are reported for both Mtce and MMTPY, scalars are typically 0.8 to 1.0. For Japan, actual imports in 2016, as well as the projected decrease in imports, include a large component of metallurgical coal and would thus typically have a Scalar towards the lower end of this range. See endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions.

334 Government of Japan, Fifth Strategic Energy Plan, July 2018, p. 24. http://www.meti.go.jp/english/press/2018/pdf/0703_002c.pdf

335 As indicated in IEA Coal 2017 (pp. 76-77), Japan has 4575 MW of new coal under construction. However as indicated by IEEFA, there is substantial additional capacity proposed but the list of active projects seems to be shrinking (projects are being suspended, without new projects being added). See Buckley, Tim and Nicholas Simon, Marubeni's Coal Problem: A Japanese Multinational's Power Business Is at Risk, Institute for Energy Economics and Financial Analysis, July 2018, p. 31.

336 Cloud Peak Energy, Press Release: "Cloud Peak Energy Signs Long-Term Coal Export Agreement with JERA Trading to Supply New Japanese IGCC Power Plant," January 16, 2018. https://investor.cloudpeakenergy.com/press-release/announcements/cloud-peak-energy-signs-long-term-coal-export-agreement-jera-trading-sup

337 Government of Japan, Fifth Strategic Energy Plan, July 2018. http://www.meti.go.jp/english/press/2018/pdf/0703_002c.pdf

338 [footnote 3 in original] *See* METI, Clean Coal Technology in Japan (Sept. 6, 2017), http://www.jcoal.or.jp/event/upload/15.%20Clean%20Coal%20Technology%20in%20Japan.pdf].

339 [footnote 5 in original] *Yoshiyuki Wakabayashi, Clean Coal Technologies for IGCC Power Plants,* MITSUBISHI HITACHI POWER SYSTEMS (Sept. 6, 2017), http://www.jcoal.or.jp/event/upload/16.%20Clean%20Coal%20Technologies%20for%20IGCC%20Power%20Plants%20%28Mr.%20Wakabayashi%29%20new.pdf.

340 https://amer.mhps.com/company.html

341 Mitsubishi Heavy Industries 2018 Medium-Term Business Plan, May 8, 2018, p. 17. https://www.mhi.com/finance/library/plan/pdf/h30_05keikaku.pdf

342 Id., p. 23.

343 https://asia.nikkei.com/Business/Companies/Mitsubishi-Heavy-to-shrink-power-business-before-orders-run-dry

344 Various sources indicate that IGCC is still generally a high cost and risky technology, especially when combined with carbon capture and storage (CCS).

IEA

https://www.brighttalk.com/service/player/en-US/theme/default/channel/7129/webcast/332065/play?showChannelList=true

IEA reports that CCS lagging (WEO 2017, pp. 60-61).

IEEFA

http://ieefa.org/wp-content/uploads/2018/07/Marubenis-Coal-Problem_July-2018.pdf p. 38

> The CCS element is particularly fraught with risk, as demonstrated by the failed Kemper coal plant in the U.S., where ballooning costs and delays resulted in the cancellation of the coal gasification and carbon capture element of the project. Shareholders were required to absorb US$6.4bn in losses. [footnote 177 in original: https://www.elp.com/articles/2018/02/kemper-plant-once-clean-coal-model-ends-in-shareholders-eating-losses.html]

Recent report on proposed IGG plant in Poland http://ieefa.org/wp-content/uploads/2018/09/Leczna-IGCC-Project_High-Costs-and-Unreliable-Operations-Can-Be-Expected_9.2018.pdf

http://ieefa.org/ieefa-report-polish-clean-coal-project-risks-high-construction-and-operating-costs-and-unreliable-performance/

Kemper/Edwardsport

http://ieefa.org/ieefa-update-kemper-edwardsport-clean-coal-myth/

http://ieefa.org/ieefa-update-duke-energys-costly-edwardsport-coal-gasification-project-continues-to-underperform/

https://iurc.portal.in.gov/_entity/sharepointdocumentlocation/47c93246-9495-e811-8259-1458d04e1b18/bb9c6bba-fd52-45ad-8e64-a444aef13c39?file=43114IGCC17%20CAC%20SubmissionPublicDirectTestimonyandExhibit1%20073118.pdf&folderPath=

345 Sources and detailed derivation of these projections are provided in Section 8.6.2.2 and corresponding endnote.

346 IEA, WEO 2017, pp. 215-16.

347 IEA Coal 2017: Analysis and Forecasts to 2022, pp. 46-47 (underlining added for emphasis). https://www.iea.org/coal2017/

348 Id., p. 103.

349 IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- 126 MMTPY (change in thermal coal imports) = 126 Mtce (change in all [thermal + metallurgical] coal imports) * 1.0 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports):
- 126 Mtce (change in all coal imports). IEA WEO 2017, p. 216 and Figure 5.9 (provided in this report as Figure 17) data download www.iea.org/weo/weo2017secure/;
- (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) = China Scalar in 2016 = 196 MMTPY thermal coal Imports/196 Mtce all coal Imports. IEA Coal 2017, pp. 39, 46, 134; IEA WEO 2017, p. 216. For import markets where data are reported for both Mtce and MMTPY), scalars are typically 0.8 to 1.0. For China, actual imports in 2016, as well as the projected decrease in imports, include a large component of metallurgical coal and would thus typically have a Scalar towards the

lower end of this range. IEA WEO 2017, p. 569; see also endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions. But for China, the projected decrease in imports, as well as actual imports in 2016, also include a large component of thermal coal imports with relatively low thermal content per MMTPY (notably from Indonesia) and thus would typically have a Scalar towards (or above) the high end of this range.

- The validity of the above analysis and estimate (126 MMTPY change in China thermal coal imports, from 2016 to 2040) is confirmed by alternative analysis (described below) resulting in a virtually identical estimate (124 MMTPY change in China thermal coal imports, from 2016 to 2040):
- 124 MMTPY (change in thermal coal imports, from 2016 to 2040) = 90 Mtce (decrease in China thermal coal imports, from 2016 to 2040) * 1.38 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports);
- 90 Mtce (decrease in China thermal coal imports, from 2016 to 2040) = 126 Mtce (decrease in all coal imports, from 2016 to 2040) – 36 Mtce (decrease in metallurgical coal imports, from 2016 to 2040);
- 36 Mtce (decrease in China metallurgical coal imports, from 2016 to 2040) = 54 Mtce (metallurgical coal imports in 2016) – 18 Mtce (metallurgical coal imports in 2040). IEA WEO 2017, Figure 14.5 data download www.iea.org/weo/weo2017secure/;
- 1.38 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports) = China Thermal Content Scalar in 2016 = 196 MMTPY Thermal Coal Imports/142 Mtce;
- 142 Mtce (China thermal coal imports in 2016) = 196 Mtce (all coal imports in 2016) – 54 Mtce (metallurgical coal imports in 2016).

[350] IEA, WEO 2017, pp. 538-539.

[351] IEA, WEO 2017, p. 540.

[352] IEA, WEO 2017, p. 542.

[353] IEA, WEO 2017, p. 568.

[354] IEA, WEO 2017, pp. p. 511-512.

[355] IEA WEO, p. 570.

[356] Id., p. 218 (underlining added for emphasis).

[357] IEA WEO 2017, pp. 563-565:

The introduction of market-based pricing in 2006, booming coal demand and tax changes, together led to a steep increase in prices and coal mining profits. These developments also led to China switching from being a net exporter of coal to a net importer in 2009. In southern coastal China – the region that is furthest away from the domestic mining hubs – coal imports became cheaper than domestic coal, leading to an influx of Indonesian, Australian and Russian coal. However, in early 2012 the price dynamics gradually started to reverse as China's coal demand growth started cooling down and it neared what was to become its peak in 2013. Since then, coal prices have declined for four consecutive years, reaching a point in early 2016 that was less than half of peak prices in 2011.

Between 2006 and 2012, while coal demand in China was shooting upwards, annual coal mining investment in China more than doubled to $65 billion, and production grew by 40%. At the height of the surge in investment in 2012, China invested 50% more than would have been needed to satisfy demand […]. When demand subsequently slowed, the effect of this surge in output capacity was to create a huge overhang of supply. We estimate that by 2015 excess mining capacity totalled up to 1 500 million tonnes per annum (Mtpa), greater than the total mining capacity of the United States, the world's second-largest coal producer.

[…]

The drop in prices that resulted from this overcapacity hit the profitability of the coal industry in China. Between 2006 and 2011, when coal prices in China were rising, coal producers focussed on ramping up production, neglecting cost discipline. As a result, average mining costs increased by more than 50%, putting producers in a tight corner when prices started dropping in 2012. Since then, dwindling profitability has forced producers to bring down costs, but the 15% drop in average mining cost achieved between 2012 and 2016 was not sufficient to offset plummeting prices. By 2015, the situation had deteriorated to the point that 80% of the coal firms in China were operating at a loss. […]

Faced with the combination of overcapacity and dwindling profitability, policy-makers had to choose between letting market forces lead the adjustment process in the coal sector and rebalancing the market actively with state intervention. A market-based rebalancing would have risked large layoffs as well as a possible financial crisis, since many coal companies had large outstanding loans, so the Chinese authorities chose to introduce a set of measures to cut capacity and manage production. […] the most effective measure taken was the reduction of annual working days from 330 to 276 […]. Introduced in April 2016, this reduced production by up to 15%, propelling coal prices upwards by some 50% within four months.

[358] This endnote provides sources for the entire section.

IEA, WEO 2017, pp. 571-72 (underlining added for emphasis):

> Our projections are subject to considerable uncertainties. With less than 10% of coal demand, imports are a relatively small item in China's coal supply balance and are very sensitive to fluctuations in the domestic coal market. […]
>
> In our projections, China remains a net importer of coal, but a switch to a net export position is also conceivable. […] One possibility is that hesitant implementation of capacity cuts could led to an aggravation of overcapacity which, perhaps in combination with a faster than expected decline of domestic coal demand, could lead to exports becoming a relief valve for a distressed coal industry. […] this could appeal to Chinese authorities if the losses from coal exports outweigh the avoided social costs such as unemployment benefits. A second possibility relates to […] productivity improvement in China […] that […] could move costs to a level that pushes out coal imports and potentially also leads to exports to nearby coal markets such as Japan or Korea. Whatever the circumstances, Chinese coal exports would have a huge impact on international markets, keeping prices low for much longer than would otherwise be the case […].

[359] See Sections 8.6.1 and 8.6.2.5 and endnotes 347 and 357.

[360] This endnote provides sources for the entire paragraph. See Section 7.5.1 and endnote 241.

[361] Sources and detailed derivation of these projections are provided in Section 8.7.2.2 and corresponding endnote.

[362] IEA, WEO 2017, p. 221.

[363] IEA, WEO 2017, p. 216.

[364] IEA, WEO 2017, p. 221 (underlining added for emphasis).

[365] IEA, IEA Coal 2017: Analysis and Forecasts to 2022, p. 104. https://www.iea.org/coal2017/

[366] IEA, IEA Coal 2017: Analysis and Forecasts to 2022, p. 114. https://www.iea.org/coal2017/

[367] IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- 25 MMTPY (change in thermal coal imports, from 2016 to 2040) = 18 Mtce (increase in India thermal coal imports, from 2016 to 2040) * 1.38 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports):
- 18 Mtce (decrease in India thermal coal imports, from 2016 to 2040) = 72 Mtce (increase in all coal imports, from 2016 to 2040) – 54 Mtce (increase in metallurgical coal imports, from 2016 to 2040);
- 72 Mtce (change in all coal imports). IEA WEO 2017, p. 216 and Figure 5.9 (provided in this report as Figure 17) data download www.iea.org/weo/weo2017secure/;
- 54 Mtce (increase in India metallurgical coal imports, from 2016 to 2040) = 72 Mtce (increase in all coal imports, from 2016 to 2040) * 3/4 (metallurgical coal share of increase in all coal imports, from 2016 to 2040). IEA WEO 2017, p. 221;
- 1.37 (Thermal Content Scalar: MMTPY thermal coal imports per 1 Mtce of thermal coal imports) = India Thermal Content Scalar in 2016 = 152 MMTPY Thermal Coal Imports/111 Mtce;
- 152 MMTPY (India thermal coal imports in 2016). IEA Coal 2017, p. 39;
- 111 Mtce (India thermal coal imports in 2016). IEA Coal 2017, p. 134.
- The validity of the above analysis and estimate (25 MMTPY change in India thermal coal imports, from 2016 to 2040) is confirmed by alternative analysis (described below) resulting in the same estimate (25 MMTPY change in India thermal coal imports, from 2016 to 2040):
- 25 MMTPY (change in thermal coal imports) = 72 Mtce (change in all [thermal + metallurgical] coal imports) * 0.35 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports);
- 0.35 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) = 0.93 (India Scalar in 2016) * 0.38;
- India Scalar in 2016 = 0.93 = 152 MMTPY Thermal Coal Imports/163 Mtce. IEA Coal 2017, pp. 39, 134; IEA WEO 2017, pp. 216, 221. For import markets where data are reported for both Mtce and MMTPY), scalars are typically 0.8 to 1.0. For India, actual imports in 2016 include a large component of metallurgical coal and thus would typically have a Scalar towards the lower end of this range. See endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions. But actual imports to India in 2016 also include a large component of thermal coal imports with relatively low thermal content per MMTPY (notably from Indonesia) and thus would typically have a Scalar towards (or above) the high end of this range.

- For India, the projected increase in imports includes a very large component of metallurgical coal (three-quarters of the total) and thus would have a Scalar below the lower end of the typical range (see IEA WEO 2017, p. 569; see also Section 8.8.2.4 and specifically endnote 387).

[368] According to IEA, WEO 2017, p. 222 (bold in original, underlining added for emphasis):

> However, this projection is subject to many uncertainties. Two are particularly important. The first concerns the rate of economic growth. […] a lower rate of growth would depress electricity demand and consequently the call on coal-fired plant […] The second concerns the rate at which the cost of alternative technologies comes down. The Indian government has made solar PV an energy policy priority and, with rising deployment levels, costs have fallen at an impressive speed […]. Over the year 2016, installed PV capacity in India increased by nearly 80% to 9 GW. India has set itself an ambitious target of reaching 100 GW of solar PV by 2022: this looks hard to achieve, but a faster-than-expected drop in costs would result in significant upside potential for solar PV and downside for coal.
>
> While coal production increases in India […] saw increases of 8% in 2014, 4% in 2015 and another 7% increase is estimated to have taken place in 2016. India's coal production is projected to increase further from around 400 Mtce in 2016 to almost 1 000 Mtce in 2040. […] Indian coal imports fell in 2016 for the second consecutive year. Over the next ten years, steam coal imports remain largely flat while imports of coking coal increase markedly. By 2040, coal imports are projected to increase from 163 Mtce in 2016 to 235 Mtce, with three-quarters of the increase in imports coming from coking coal.
>
> […] the projection of rising steam coal imports from the late 2020s is subject to considerable policy uncertainty. […] For the moment, imports appear to be the cheapest supply option along most of India's western coastline. However, it cannot be taken for granted that domestic coal would be at a disadvantage […] The possibility of a strengthened future policy commitment to renewables, or indeed to natural gas, also raises questions about India's future coal demand and, in turn, its import requirements. A reversal in the projected trend of rising imports is possible if circumstances change: this would have significant repercussions for coal exporters around the world.

[369] IEA, WEO 2017, pp. 220-221 (underlining added for emphasis).

[370] **Other developing Asia** includes the Southeast Asia region and the "Other Asia" region. As defined in Coal 2017 (pp. 101, 108-109):

Southeast Asia region is Brunei Darussalam, Cambodia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam; these are the countries that are members of ASEAN, excluding Indonesia (which is a large coal exporter). As defined in WEO 2017 (pp. 226, 749) for the analysis of imports by region (Figure 5.9, provided in this report as Figure 17).

Other Asia region is Bangladesh, Chinese Taipei, Nepal, New Zealand, Pakistan, Sri Lanka and other countries and territories (see below). This definition is based on the Asia Pacific region as defined in WEO 2017 [Southeast Asia region (defined above), and Australia, Bangladesh, China, Chinese Taipei, India, Japan, Korea, Democratic People's Republic of Korea, Mongolia, Nepal, New Zealand, Pakistan, Sri Lanka and other countries and territories (where individual data are not available and are estimated in aggregate: Afghanistan, Bhutan, Cook Islands, Fiji, French Polynesia, Kiribati, Macau (China), Maldives, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste and Tonga and Vanuatu)], excluding coal import regions individually accounted for in Figure 5.9 (China, India, Korea, Japan, and Southeast Asia), and also excluding net coal exporters (Australia, Democratic People's Republic of Korea, and Mongolia). As defined in WEO 2017 (pp. 225-226, 488, 748-749) for the analysis of imports by region (Figure 5.9, provided in this report as Figure 17).

371 Sources and detailed derivation of these projections are provided in Section 8.8.2.2 and corresponding endnote 376.

372 IEA WEO 2017, pp. 215-216.

373 IEA Coal 2017, pp. 101, 108-109.

374 IEA Coal 2017, p. 108 (bold in original, underlining added for emphasis).

375 153 MMTPY = 59 MMTPY (Taiwan) + 94 MMTPY (Other Asia). IEA Coal 2017, p. 39.

376 IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- 160 MMTPY (change in thermal coal imports) = 174 Mtce (change in all [thermal + metallurgical] coal imports) * 0.92 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports);
- 174 Mtce (change in all coal imports) = 108 Mtce (Southeast Asia) + 66 Mtce (Other Asia). IEA WEO 2017, Figure 5.9 (provided in this report as Figure 17) data download www.iea.org/weo/weo2017secure/;
- 0.92 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) estimated based on upper end of range (which will result in a higher estimate of projected imports): for import markets where data are reported for both Mtce and MMTPY (IEA Coal 2017, pp. 39, 134), scalars are typically 0.8 to 1.0. The Scalars for Southeast Asia and Other Asia might be in the order of 0.87 and 1.0, respectively. For

Southeast Asia, the projected increase in imports includes a large component of metallurgical coal and would thus typically have a Scalar towards the lower end of the typical range (0.8 to 1.0). See Section 8.8.2.3.3 and specifically endnote 387; see also endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions.

377 IEA Coal 2017, pp. 108, 134 (Table A.7: other developing Asia = Chinese Taipei + South Asia).

378 IEA Medium-Term Coal Market Report 2016 projected a 78 Mtce increase in Southeast Asia thermal coal imports, while IEA Coal 2017 projected an increase of only 41 Mtce. Likewise, the 2016 Report projected that thermal coal imports would increase overall in Asia and worldwide, while the 2017 Report projected that imports would decrease overall. IEA Medium-Term Coal Market Report 2016 (pp. 98-99, 127); IEA Coal 2017 (pp. 101, 108, 134)

379 IEA WEO 2017, p. 205 (bold added for emphasis).

380 [footnote 7 in original] For a more detailed analysis, please refer to Southeast Asia Energy Outlook: World Energy Outlook Special Report […] available at *www.iea.org/southeastasia*.

381 IEA WEO 2017, p. 227 (bold added for emphasis). The cited discussion of Southeast Asia refers to the entire region, including Indonesia; in the analysis of coal imports by region (WEO 2017 Figure 5.9, provided in this report as Figure 17), Southeast Asia does not include Indonesia; see endnote 370.

382 IEA Southeast Asia Energy Outlook: World Energy Outlook Special Report, October 2017; see endnote 380 and IEA WEO 2017, pp. 5, 64, 227, 643.

383 Southeast Asia Energy Outlook Figure 1.5 (p. 23) shows that investment decisions on new coal-fired power generation (in Southeast Asia outside Indonesia) have dropped from over 10 GW in 2014 to under 4 GW in 2016.

384 IEA Southeast Asia Energy Outlook: World Energy Outlook Special Report, p. 23.

385 Id., p. 60 (underlining added for emphasis).

386 This endnote provides sources for the entire paragraph. IEA Southeast Asia Energy Outlook: World Energy Outlook Special Report, pp. 46-47,82, 122-123,134-137.

387 This endnote provides sources for the entire paragraph. http://www.minerals.org.au/sites/default/files/181012%20Commodity%20Insights%20Met%20Coal%20Report.pdf; IEA Southeast Asia Energy Outlook: World Energy Outlook Special Report, pp. 58, 64, and especially 65:

> Coal consumption more than doubles to 2040, partly due to the increased use of blast furnaces in the steel industry, which accounts for one-third of the rise.

The cited discussion of Southeast Asia refers to the entire region, including Indonesia; in the analysis of coal imports by region (WEO 2017 Figure 5.9, provided in this report as Figure 17), Southeast Asia does not include Indonesia; see endnote 370.

See also endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and coal imports in various countries/regions.

[388] See endnote 370.

[389] IEA Coal 2017, p. 108, see also p. 50.

[390] IEA Coal 2017, p. 108, see also p. 134.

[391] IEA Coal 2017, p. 14 (bold in original):

> **Uncertainty is the main certainty for the coal trade**
>
> **Imports to** […] **Chinese Taipei are under pressure.** […] In Chinese Taipei, where new coal capacity is coming on line, coal is facing growing social opposition.

[392] https://www.eia.gov/beta/international/analysis.php?iso=TWN

[393] This endnote provides sources for this entire paragraph, as well as the next entire paragraph. See Sections 4 and 70 (especially Sections 4.5, 4.6, and 7.5.1).

[394] IEA, WEO 2017, pp. 225-26.

[395] Id., p. 216.

[396] This endnote provides sources and notes for the entire paragraph. IEA WEO 2017 does not provide a specific estimate for change in thermal coal imports (MMTPY, from 2016 to 2040), so TGG developed a reasonable approximation based on data reported by IEA:

- IEA WEO 2017 projects total coal exports to Europe, but does not provide a breakdown for thermal and metallurgical coal. If thermal coal imports decline at the same rate as all imports, 63 MMTPY (change in thermal coal imports) = 68 Mtce (change in all [thermal + metallurgical] coal imports) * 0.93 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports);
- 68 Mtce (change in all coal imports). IEA WEO 2017, p. 216;
- 0.93 (Scalar: MMTPY thermal coal imports per 1 Mtce of all coal imports) = Europe Scalar in 2016 = 192 MMTPY Thermal Coal Imports/206 Mtce. IEA Coal 2017, pp.

39, 107; IEA WEO 2017, pp. 225-226. For import markets where data are reported for both Mtce and MMTPY, scalars are typically 0.8 to 1.0. For Europe, actual imports in 2016 include a large component of metallurgical coal (indicating a Scalar towards the lower end of this range), as well as a large component of thermal coal imports with relatively low thermal content per MMTPY (indicating a Scalar towards (or above) the high end of this range); the combined effect of these factors is a Scalar somewhat towards the upper end of this range.

- The above estimate may somewhat understate the decrease in thermal coal exports from 2014 to 2040. If thermal coal imports decline more rapidly than metallurgical coal and all imports, the decrease in thermal coal exports would likely be 65 MMTPY or more, and the Scalar would be 0.95 or more (somewhat more towards the upper end of the typical range). See endnote 325 for additional information and analysis regarding relationships between steel production, metallurgical coal, and imports in various countries/regions.

[397] This endnote provides sources and notes for the entire paragraph. See endnote 396.

[398] [footnote 6 in original] Korea, South, U.S. ENERGY INFO. ADMIN. (Jan. 19, 2017), https://www.eia.gov/beta/international/analysis.cfm?iso=KOR [sic]. [The link provided in the Complaint accesses the most recently released version of the US EIA South Korea Analysis, which is now the July 16, 2018 version. The earlier (January 19, 2017) version cited in the Complaint is archived on the EIA site. https://www.eia.gov/beta/international/analysis_includes/countries_long/Korea_South/archive/pdf/south_korea_2017.pdf

[399] See Sections 4.3 and 4.7 (specifically endnote 40).

[400] South Korea is a large user of metallurgical coal, all of which is imported (including Canadian production via Westshore and Ridley). Large volumes of metallurgical coal imports are required because South Korea is a large steel producer, in part to supply other major activities, including a large, steel-intensive shipbuilding industry. South Korea also imports virtually all of its thermal coal supply, but does produces a relatively small amount of thermal coal (anthracite). US EIA South Korea Analysis (see endnote 398); http://www.keei.re.kr/keei/download/MES1803.pdf p. 63 (cited in US EIA South Korea Analysis); IEA Coal 2017, p. 39-40 and especially p. 114:

> Japan and Korea are […] large importers in the seaborne traded met coal market. Both nations
>
> lack domestic coking coal resources, but both are large steel and BFI producers, so depend strongly on imports. As the Korean economy is expected to grow strongly by approximately 3% per year over the next five years, met coal imports are projected to increase by 1.8% per year. Japan's economy, which is more mature than Korea's, is projected to grow more slowly, resulting in a 1.9% per year decline in met coal imports through 2022. See endnote 325

for additional information and analysis regarding relationships between steel production, metallurgical coal, and imports in various countries/regions

401 See endnote 400.

402 The South Korean utilities are Korea Southern Power Company (KOSPO) and Korea Southeast Power Company (KOSEP), which are both wholly owned subsidiaries of Korea Electric Power Corporation (KEPCO)). See endnote 124.

It should also be understood that in addition to the above discussed coal sales contracts with South Korean utilities, these utilities also provided financing to Ambre Energy, the parent company of Ambre Energy North America (now known as Lighthouse). See endnote 94.

403 *Western Minerals LLC v. KCP, Inc.; Ambre Energy North America, Inc.; and Ambre Energy Ltd.*, US District Court, District of Montana Billings Division, Case No. CV-12-85-BLG-RFC-CSO, Answer, Counterclaim and Third-Party Complaint, July 30, 2012, pp. 44-45, ¶¶27-29 and 32 (underlining added for emphasis). http://publish.generationhub.com/document/2012/08/01/Ambre%20Response%20Filing.pdf

As explained in Section 5.6.2, Ambre acquired a 50% ownership share in Decker Mine in 2011 from Level 3 Communications. As explained in Section 5.6.3.4, Cloud Peak Energy (which owned the other 50% of Decker) initiated litigation against Ambre, on July 9, 2012. http://media.oregonlive.com/environment_impact/other/CloudPeakSuit.pdf

Ambre (through its subsidiaries) responded in the July 30, 2012 document.

404 The Complaint does not provide the specific location of the Canadian port, but Lighthouse has elsewhere specified that it commenced shipments in October 2016 via Westshore Terminals in Metro Vancouver, BC and that all Lighthouse exports are via Westshore. *Lighthouse et al. v. Inslee et al.*, US District Court, Western District of Washington at Tacoma, Case No. 3.18-dv-05005-RJB, State Defendants' Interrogatories and Requests for Production to Plaintiffs and Plaintiffs Objections, Answers and Responses Thereto; July 18, 2018, Interrogatory Responses 4 and 7; http://www.lighthouseresourcesinc.com/lighthouse-resources-sending-coal-to-asia/

405 https://www.eia.gov/coal/data/browser/#/topic/41?agg=1,2,0&rank=ok&cntry=000000000000000000000g0000&cust=vvvvvrvvv&linechart=~COAL.EXPORT_QTY.STM-KR-TOT.A~COAL.EXPORT_QTY.MET-KR-TOT.A~&columnchart=COAL.EXPORT_QTY.TOT-KR-TOT.A&map=COAL.EXPORT_QTY.STM-KR-TOT.A&freq=A&start=2007&end=2017&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=

406 https://www.eia.gov/coal/data/browser/#/topic/41?agg=1,2,0&rank=ok&cntry=000000000000000000000000g0000&cust=vvvvvrvvv&linechart=~COAL.EXPORT_QTY.STM-KR-TOT.Q~COAL.EXPORT_QTY.MET-KR-TOT.Q~&columnchart=COAL.EXPORT_QTY.TOT-KR-TOT.Q&map=COAL.EXPORT_QTY.STM-KR-TOT.Q&freq=Q&start=200704&end=201802&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0

407 The EIA Coal Data Browser provides a breakdown of coal exports by Customs District (i.e., where the coal leaves the US). In many cases (such as Los Angeles and Norfolk), Customs District coincides with port location; exports are via a US port where coal is loaded onto marine vessels for export. But in some cases, export is via a port outside the US, and the US Customs District is the location where rail traffic exits the US (notably Seattle Customs District for exports via Westshore). See US EIA, Europe and Asia are the leading destinations for U.S. coal exports in 2012, November 15, 2012 https://www.eia.gov/todayinenergy/detail.php?id=8790; Ernst & Young, U.S. Coal Exports: National and State Economic Contributions, Prepared for the National Mining Association, May 2013, p. 4 http://www.uscoalexports.org/data/National-and-State-Economic-Contributions.pdf [referenced in footnote 11 of the Complaint].

Customs District sources:

https://www.eia.gov/tools/glossary/index.php?id=C

https://www.census.gov/foreign-trade/schedules/d/distcode.html

https://www.census.gov/foreign-trade/schedules/d/dist.txt

408 Figure 27 and Figure 28 include all US thermal coal exports to South Korea, via all Customs Districts/ports (see endnote 407). The large majority of US thermal coal exports to South Korea are via rail traffic exiting the US in the Seattle Customs District for export via Westshore. Thermal coal exports via Seattle (and Westshore) were zero in 2016 Q1 through Q3.

409 See Section 9.4.2.1 and endnote 403 for information regarding pricing in Lighthouse contracts with South Korean utilities. See Sections 7.4.2 and 7.6 for additional information regarding pricing for coal exports and the prevailing prices in Asian coal export markets.

410 IEA Coal 2017, pp. 50-52.

411 See endnote 404.

412 All US coal exports via Seattle (rail to Westshore) are thermal coal. Westshore handles metallurgical coal (from Western Canadian production), but there is no US metallurgical coal production that is proximate and economically viable to export via Pacific Northwest ports. US metallurgical coal production is concentrated in Appalachia

and is proximate to existing ports on the US East and Gulf Coast. See Sections 4.5, 4.6, and 7.7.3.

413 https://www.eia.gov/coal/data/browser/#/topic/41?agg=2,1,0&rank=ok&cntry=vvvvvvvvvvvvvvvvvvvvvvvvvvvto&cust=00000000g&linechart=COAL.EXPORT_QTY.STM-TOT-SE_WA.A~COAL.EXPORT_QTY.STM-CN-SE_WA.A~COAL.EXPORT_QTY.STM-JP-SE_WA.A~COAL.EXPORT_QTY.STM-KR-SE_WA.A~COAL.EXPORT_QTY.STM-TW-SE_WA.A&columnchart=COAL.EXPORT_QTY.TOT-TOT-SE_WA.A&map=COAL.EXPORT_QTY.TOT-TOT-TOT.A&freq=A&start=2007&end=2017&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=

414 https://www.eia.gov/coal/data/browser/#/topic/41?agg=2,1,0&rank=ok&cntry=vvvvvvvvvvvvvvvvvvvvvvvvvvvto&cust=00000000g&linechart=COAL.EXPORT_QTY.STM-TOT-SE_WA.Q~COAL.EXPORT_QTY.STM-CN-SE_WA.Q~COAL.EXPORT_QTY.STM-JP-SE_WA.Q~COAL.EXPORT_QTY.STM-KR-SE_WA.Q~COAL.EXPORT_QTY.STM-TW-SE_WA.Q&columnchart=COAL.EXPORT_QTY.TOT-TOT-SE_WA.Q&map=COAL.EXPORT_QTY.TOT-TOT-TOT.Q&freq=Q&start=200704&end=201802&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=

415 As further explained in the next section (Section 10.4.2), in addition to on-site jobs, Lighthouse has estimated that building and operating the Project will result in spin-off jobs throughout the Washington economy.

416 Total employment includes wage and salary jobs, as well as proprietors (self-employed) jobs. Total employment in Washington was approximately 4.4 million in 2017, including more than 3.5 million wage and salary jobs and more than 0.8 million proprietors. Wage and salary jobs increased to almost 3.6 million by Q2 2018, so total employment (including proprietors) would now likely exceed 4.4 million. Data on wage and salary jobs are released each month, for the preceding month, by US BLS (Bureau of Labor Statistics). Data on employment (total, wage and salary, and proprietor) by state are released annually (typically in September), for the preceding year, by US BEA (Bureau of Economic Analysis).

https://washington.reaproject.org/analysis/major-components/total_employment/tools/530015/

https://www.bls.gov/eag/eag.wa.htm

https://www.bea.gov/data/employment/employment-by-state

https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1

417 See for example https://erfc.wa.gov/forecasts/economic-forecast.

418 It should be understood that the estimates of jobs provided (by both BERK and TGG) are in terms of job-years (1 job-year = 1 full-time job for 1 year). See endnote 426 for a more detailed discussion of job-years.

419 FEIS, 2-21.

420 1350 jobs over 5 years (the construction duration assumed in the BERK Study) would be only 270 jobs per year. See BERK Study, p. 18 and endnote 426.

421 The Complaint cites the BERK study, but does not fully specify all of the claims included in the BERK Study. As discussed in Section 10.5.1, the Complaint relies on the BERK study to claim job impacts in Washington, and then contradicts BERK to claim job impacts outside Washington. TGG's analysis of job impacts is rigorous, comprehensive, and based on our deep expertise and long experience in the evaluation of employment impacts of energy infrastructure projects. We have therefore reviewed the BERK study comprehensively, as well Lighthouse's claims elsewhere (e.g. Lighthouse's website and MBT's website).

422 BERK, Economic & Fiscal Impacts of Millennium Bulk Terminals Longview, prepared for Millennium, April 12, 2012. http://millenniumbulk.com/wp-content/uploads/2014/10/Economic-Study-Full-Report.pdf

The Complaint in federal litigation (¶72, footnote 7) also refers to the FEIS in regard to the Project expecting to add 1300 construction jobs and approximately 135 operations jobs. As the FEIS makes clear, these estimates were provided by Millennium. And as explained in this Section, the information cited in the Complaint concerning job impacts in Washington (including what was provided by Millennium and cited in the FEIS) is based on the BERK Study.

As explained in Section 5.6.5, MBT ownership from 2011 to 2016 was 62% Lighthouse and 38% Arch Coal, and since then 100% Lighthouse.

423 BERK p. A-3-A-4 (bold in original):

> This study measures the three main types of economic impacts:
>
> • **Direct Impacts**. Direct impacts are not necessarily the amount of money spent on an initial purchase. They are, instead, **the amount of that initial purchase that will remain within the local economy**. For example, when the construction company purchases tools from a local company, that supplier may send some of that money to their headquarters and some to their manufacturers in another country, and the rest will be spent on local employees and purchases from businesses within the region. The direct impact is only the amount that the supplier re-spends within the region because that is the portion that affects the local economy.
>
> • **Indirect Impacts.** Indirect impacts result **when an industry makes purchases from another industry**. For example, when the construction

company purchased a tool from a supply store, that store owner must then make more purchases from its suppliers. This is an indirect impact.

- **Induced Impacts.** Induced impacts occur from the **expenditures of employee wages**. When the construction company purchased a tool from the supply store, the salesperson received a wage for working in the shop. The wages that are then put back into the local economy as that employee makes purchases for his or her household is the induced effect of the tool purchase.

[…]

Statewide economic impacts are modeled using the Washington State Input-Output Model developed for the Washington State Office of Financial Management. This model was developed to trace the ripple effects of an expenditure that occurs within the economy. The model tracks how an economic action will ripple through an economy creating different levels of revenue, jobs, and income based on the economic sector.

[424] BERK Study, p. 22.

[425] BERK Study, p. 22.

[426] Various jobs can be of various intensities and durations, and it is useful to define them by expressing them in terms of a standard measure, such as job-years (also known as person-years). 1 job-year = 1 fulltime job for 1 worker for 1 year. But 1 job-year could also be 2 fulltime jobs for 6 months each or 2 halftime jobs for 1 year. The BERK Study job estimates (notably for Project construction that would occur over a multi-year period) are in terms of job-years (DEIS, p. 3.2-21; similar content is provided in NEPA DEIS, p. 4.2-20-4.2-21):

> […] construction of the Proposed Action would require approximately 1,350 direct jobs, which could generate an additional 1,300 indirect and induced local and regional jobs during construction with approximate wages of $65 million and an additional economic output of $203 million (BERK 2012). Input-output models used to estimate the impacts of total wages over multiple years provide estimates of jobs in terms of job-years. Therefore, 1,300 indirect and induced jobs resulting from construction wage expenditure over 5 years, are the equivalent of 260 job positions held for the 5-year duration of construction. [footnote 4 in original: The economic and fiscal impact study prepared by BERK for the Proposed Action used a 5-year construction
>
> duration for its assessment of economic impacts during the construction period.]

[427] As discussed in Section 5.2.3, and specifically BERK Study, pp. 23-24.

[428] This endnote provides sources and notes for the entire paragraph. BERK Study, pp. 18, 23-24, A-5, especially p. A-5 (underlining added for emphasis):

> Temporary construction jobs and wages were estimated using the Washington State Input-Output Model (I/O Model) developed for the Washington State Office of Financial Management. The I/O Model estimates that for every $1 million (2010$) of direct business spending (output) would result in about 5.82 direct construction jobs and $0.30 in direct wages. Total construction expenditures are estimated to be about $600 million, which are based on the 2011 Millennium Bulk Terminals Coal Export Feasibility Study. However, as much as half of this cost is for equipment purchases that would not result in any direct job impact. Accounting for these costs reduces the on-site construction expenditures that would result in direct job impacts to about $232 million. This $232 million in direct construction output will produce 1,350 temporary direct jobs and $70 million in direct wages.

Hence, these monetary figures (e.g., $232 million for construction costs and 5.82 JPM) are 2010$. BERK Study (p. 18) estimates direct costs (which do not include taxes or indirect costs) to be about $643 million in year of expenditure (YOE) dollars, including Stage 1 ($478 million in 2013-2016) and Stage 2 ($165 million in 2016-2018). Millennium now reports a $680 million project cost (see e.g., http://www.millenniumbulk.com/wp-content/uploads/2017/10/Millennium-Files-Claim-against-Ecology-in-Court-Appeals-Denial-of-Water-Quality-Certification-1.pdf in 2017). A $680 million project cost (in 2017$) is roughly consistent with the BERK cost estimates and project construction that would occur later than assumed in BERK Study.

[429] The BERK Study does not provide any information regarding to what extent equipment will be sourced from suppliers located within the US (in states outside Washington) or will be located outside the US.

[430] FEIS pp. 2-24, 2-26 (Note b), 5.3-8; see also BERK Study, pp. 18-19. Proposed rail operations and coal export terminal design would support terminal throughput of 40 MMTPY for Stage 2, but Applicant assumes a 10% increase in throughput (4 MMTPY) is possible with rail car capacity increases, through process efficiency and technological improvements by 2028, the first year of assumed full operations.

[431] Stated in technical (economics) terminology, there are economies of scale for coal export terminals (and similar facilities), with larger scale enabling higher labor productivity. The FEIS (p. 2-1) and NEPA DEIS (pp. 2-1, 2-13) also refer to economies of scale for the Project.

[432] Assuming 2000 hours per year, per employee. On-site employment includes administrative staff (25 employees), as well as terminal upland and waterfront staff (110 employees for Full Build-Out Operations). BERK Study, p. 19. Hence, there would be only 110 employees more directly involved in coal handling. With Full Build-Out Operations, throughput per coal handling employee would be 400,000 metric tons per year, or 200 metric tons per hour (assuming 2000 hours per year, per employee).

433 We note however, that the job impacts for Full Build-Out/Stage 2 Operations (44 MMTPY) are only marginally larger than for Stage 1b Operations (25 MMTPY); the number of employees required to operate Millennium appears to be similar regardless of throughput. That said, even if Stage 2 Full-Build-Out Operations are eventually achieved, this would be after a ramp-up that could extend until 2028. Hence, even if BERK's assumption of 44 MMTPY at full throughput were realistic (which it is not), the associated operating jobs would not be created until 2028.

434 NEPA DEIS, p. 4.2-5—4.2-7 (bold in original, underlining added for emphasis); similar content is provided in SEPA DEIS, p. 3.2-5; see also endnote 435.

435 The SEPA FEIS removed this assessment of potential Project impacts on the local economy, based on estimates from the BERK Study. FEIS, p.1-6.

436 See endnotes 423 and 428. The BERK Study used the then available 2002 version of the Washington State Input-Output Model. Subsequent to the BERK Study, the 2007 version of the Washington State Input-Output Model has become available. https://www.ofm.wa.gov/washington-data-research/economy-and-labor-force/washington-input-output-model

437 https://www.ofm.wa.gov/sites/default/files/public/legacy/economy/io/2002/io2.pdf

438 The BERK Study estimates economic impacts using the Washington State Input-Output Model, which estimates labor income (see endnotes 423 and 428). Labor income includes benefits as well as wages. The BERK Study inconsistently characterizes its estimates as "labor income and "wages," but the BERK estimates appear to be consistently "labor income" rather than "wages."

439 http://www.efsec.wa.gov/Tesoro%20Savage/Adjudication/Exhibits/Tesoro/Exhibit%200156-000018-TSS.pdf p. 11. The Tesoro Savage and Millennium projects are similar in many ways; both are rail to marine transload terminals in southwest Washington (at Columbia River miles 103.5 and 63, respectively).

440 NEPA DEIS pp. 4.2.22-4.2.23 (underlining added for emphasis); similar content is provided in SEPA DEIS, p. 3.2-23.

441 As explained in endnote 423, induced impacts occur from the expenditures of employee wages. Hence, an overestimate of employee wages will result in an overestimate of induced jobs.

442 BERK Study, p. 22.

443 Ernst & Young, U.S. Coal Exports: National and State Economic Contributions, Prepared for the National Mining Association, May 2013. http://www.uscoalexports.org/data/National-and-State-Economic-Contributions.pdf

[referenced in footnote 11 of the Complaint]; referred to in this report as "the NMA Study.

The NMA Study is cited in the Complaint specifically in reference to job impacts outside Washington (as a footnote to ¶75).

444 Robert Godby et al., Centre for Energy Economics and Public Policy, The Impact of the Coal Economy on Wyoming, Prepared for: Wyoming Infrastructure Authority, February 2015. https://www.uwyo.edu/cee/_files/docs/wia_coal_full-report.pdf [referenced in footnote 16 of the Complaint]; referred to in this report as "the CEE Study.

The CEE Study is cited in the Complaint in reference to the economic (including employment) benefits of Wyoming coal production (as a footnote to ¶77). The CEE Study specifically analyzes job impacts of coal production in WY for export to Asia via Pacific Northwest terminals, but this analysis of exports is not discussed in the Complaint in federal litigation.

445 Barkey, Patrick S., Bureau of Business and Economic Research, The Economic Impact of Increased Production at the Spring Creek Mine, Prepared for: Montana Chamber of Commerce, October 2012. http://www.bber.umt.edu/pubs/econ/spring%20creek%20mine%20Report.pdf referred to in this report as "the BBER Study."

446 As explained in Sections 4.7, 8.3, and 8.4, most (if not all) of the coal potentially exported via Millennium would originate from the Powder River Basin, especially in Montana. Moreover, Spring Creek coal has already been exported to Asia via existing Pacific Northwest terminals (notably Westshore).

447 20 million tons per year is expressed in terms of MMst (million short tons) per year and is equivalent to 18.1 MMTPY. See endnote 450 for an explanation of TGG's approach to the use of these different units (i.e. short tons versus metric tons) in our analysis.

448 As will be explained in Section 10.5.9, the assumption of full throughput (44 MMTPY of coal) is used as a starting point to determine the upper limit of jobs outside Washington. A more realistic throughput estimate would be 0 to 44 MMTPY, in which it is unlikely for the Project to operate consistently close to full throughput. Based on this more realistic estimate, the mining job impacts would be small to non-existent.

449 As will be discussed in Section 10.5.7, this distribution of production between Montana and Wyoming is somewhat arbitrary and conservative. The NMA and CEE Studies also scaled results in order to estimate job impacts for various amounts of coal production. In turn, we have scaled the results from the NMA and CEE Studies to develop job estimates for the coal production that might be exported by Millennium.

Therefore, our assumptions and methodology provide results which are representative and conservative (will tend to overstate job impacts).

[450] Data in the source studies are generally in terms of tons (aka short tons), rather than metric tons (aka tonnes). For consistency with sources, most of the underlying analysis has been done in terms of MMst (million short tons). Summary statistics (notably in terms of jobs per ton) in Table 7 and Table 8 are provided for metric units (notably in terms of jobs per MMTPY (million metric tons per year of Millennium terminal throughput)).

[451] Details regarding the data, assumptions, and methodology underlying the estimates in Table 7:

1. For the purposes of our estimates of job impacts outside Washington, we assume that all of the coal exported from the Project would come from the Powder River Basin in Montana and Wyoming. We recognize that a small portion of the coal exported via Millennium could come from the Uinta Basin in Colorado and Utah, but it is a reasonable simplification to assume that all of the coal exports come from Montana and Wyoming.

2. TGG has assumed that Montana's share of the 44 MMTPY (i.e. Project exports at full throughput) is 33 MMTPY while Wyoming's share is 11 MMTPY. This assumption is based on the percentage of each state's share of US exports as provided in the NMA Study.[451] This somewhat arbitrary and conservative assumption is further discussed in Section 10.5.7.

3. NMA job estimates for exports from Montana (13.2 MMst per year/12.0 MMTPY in 2011) are scaled to the volume of TGG's assumed share of Millennium full throughput exports from Montana (33 MMTPY). Similarly, NMA job estimates for exports from Wyoming (4.5 MMst per year/4.1 MMTPY in 2011) are scaled to the volume of TGG's assumed share of Millennium full throughput exports from Wyoming (11 MMTPY).

4. As noted by NMA (pp. 17-19), mining activities result in direct jobs in the mining state, as well as spin-offs (indirect and induced jobs) in the mining state and in other states. Table 7 provides estimates of spin-off (indirect and induced jobs) for Montana and Wyoming, other states, and all US.

5. Spin-offs are estimated based on NMA analysis using IMPLAN input-output models (for each state and nationally) (NMA, p. 7 and Appendix A).

6. Spin-offs in mining states (Montana and Wyoming) are estimated based on NMA estimates for spin-offs in those states. Spin-offs in all US are estimated based on NMA estimated multiplier (1 direct mining job supports 2.52 spin-offs jobs in all US (NMA, pp. iii, 8-9). Spin-offs in other states (besides Montana and Wyoming) are estimated as follows: Spin-offs in all US minus spin-offs in mining states (Montana and Wyoming).

[452] This endnote explains why the Table 7 estimates based on the NMA Study likely overstate the direct job impacts related to the Project especially in Montana. NMA estimates the direct export jobs for these states based on a) direct coal mining employment for all production in each state (NMA, pp 5-6); and b) exports as a percentage of each's state's production (NMA, Table 1, p. 3). For each mining state, TGG then scales these NMA job impact estimates to the volume of TGG's assumed share of Millennium full throughput exports (i.e. 33 MMTPY for Montana and 11 MMTPY for Wyoming).

Wyoming coal production is very large (about 400 MMTPY in the NMA Study, based on 2011 data). Virtually all of Wyoming coal comes from Powder River Basin surface mines. Wyoming Powder River Basin production is concentrated in large mines and has high labor productivity (high tons per direct job and thus low jobs per ton). Therefore, the composition of the overall coal production in Wyoming is mainly representative of the Wyoming coal that could potentially be exported via the Project. The assumed Wyoming share of exports from the Project, even at full throughput, would be a relatively small portion of overall Wyoming production.

Compared with Wyoming, Montana coal production is much smaller (about 35 MMTPY in the NMA Study, based on 2011 data). Also compared with Wyoming, Montana coal comes from smaller mines, including an underground bituminous coal mine, and has lower labor productivity (lower tons per direct job and thus higher jobs per ton). Therefore, the composition of the overall existing coal production in Montana is less representative of the Montana coal that could potentially be exported via the Project.

The assumed Montana share of exports via the Project, especially at full throughput, would be a very large portion of overall Montana production. 33 MMTPY constitutes over 90% of the 35 MMTPY of overall Montana coal production, based on 2011 data (NMA Study). And 33 MMTPY would also be a very large portion relative to actual

Montana coal production in more recent years. Given that it is unlikely that virtually all existing Montana coal production would be used to supply Millennium, some incremental coal production to supply the Project could come from Wyoming and/or new production in Montana (which could be developed to supply Millennium).

The Montana coal production potentially exported via the Project could come from large surface mines (new mines or major expansions of existing mines) that have higher labor productivity (high tons per direct job and thus low jobs per ton). Put another way, Montana mines exporting coal via the Project could be more similar to mines in Wyoming.

As indicated above, the NMA Study estimates the direct export jobs for these states based on a) direct coal mining employment for all production in each state (NMA, pp 5-6); and b) exports as a percentage of each's state's production. But the composition of the overall existing coal production in Montana is less representative of the Montana coal that could potentially be exported via the Project. Montana's overall existing coal production is characterized by a lower labor productivity than Montana's potential exports via the Project. Hence, TGG's higher direct job estimates, which are based on the job estimates of the NMA study, could be overstated, particularly for Montana.

Given that we are assuming that 33 MMTPY (or 75%) of the coal exports at full throughput will originate in Montana, the overstatement of mining job impacts could be further amplified by basing estimates solely on the NMA Study.

453 The REMI model incorporates aspects of the input-output model approach, but also has other components that are dynamic and result in estimated jobs impacts. http://ledsgp.org/resource/regional-economic-models-inc/?loclang=en_gb

454 According to the CEE Study (p. 25), "Impact modelling used a modified version of IMPLAN […] specifically customized by the authors using state-specific data to more accurately conditions in Wyoming."

455 Most workers at Spring Creek Mine reside in Wyoming, but all jobs at Spring Creek are included in the BBER Study estimates of Montana jobs; in technical nomenclature, jobs are estimated based on place-of-work, rather than place-of-residence. BBER Study (pp. 4, 6, including map showing location of mine).

456 As explained in Section 10.5.4:

- BBER Study (Montana) analyzes coal production at Spring Creek mine for export to Asia via Pacific Northwest terminals.
- CEE Study (Wyoming) is cited in Complaint in regard to job impacts of Wyoming coal production; the CEE Study specifically analyzes job impacts of coal production

in Wyoming for export to Asia via Pacific Northwest terminals, but this analysis of exports is not discussed in the Complaint.

[457] Details regarding the data, assumptions, and methodology underlying the estimates in Table 8 are provided below. Note that ¶¶ 1, 2, 6, 7 and 8 are the same as those listed in relation to Table 7, but are repeated for clarity here.

1. For the purposes of our estimates of job impacts outside Washington, we assume that all of the coal exported from the Project would come from the Powder River Basin in Montana and Wyoming. We recognize that a small portion of the coal exported via Millennium could come from the Uinta Basin in Colorado and Utah, but it is a reasonable simplification to assume that all of the coal exports come from Montana and Wyoming.

2. TGG has assumed that Montana's share of the 44 MMTPY (i.e. Project exports at full throughput) is 33 MMTPY while Wyoming's share is 11 MMTPY. This assumption is based on the percentage of each state's share of US exports as provided in the NMA Study.[457] This somewhat arbitrary and conservative assumption is further discussed in Section 10.5.7.

3. The BBER Study analyzes the job impacts from 20 MMst per year/18.1 MMTPY increase in mine output. To estimate the job impacts of 33 MMTPY of coal exports from Montana, TGG scales the BBER Study job impact results from 18.1 MMTPY to 33 MMTPY.

4. Based on Spring Creek operations in 2011 (311 employees and on-site contractors producing 19.1 MMst), the BBER Study estimates 326 direct mining jobs (including contractors) for 20 MMst additional production.

5. The BBER Study estimates total job impacts using the REMI model. The REMI model includes an input-output model, but also has other components that are dynamic and result in year-by-year variations in estimated jobs. BBER job estimates increase slightly (less than 3%) in the first several years after 2018 (the assumed first year of full production for exports (20 MMst)), but then decline so that the average total jobs for 2018-2038 is about 92% of the jobs in 2018. TGG therefore uses the 20-year average (2018-2038) for total jobs.

6. The BBER Study estimates total jobs based on a scenario including mining and rail jobs (both of which result in spin-offs). TGG estimates total jobs for mining based on direct jobs for mining and the BBER multiplier (total jobs/direct jobs).[457]

7. As noted by NMA (pp. 17-19), mining activities result in direct jobs in the mining state, as well as spin-offs (indirect and induced jobs) in the mining state and in other states. Table 8 provides estimates of spin-off (indirect and induced jobs) for Montana and Wyoming, other states, and all US.

8. Spin-offs are estimated based on NMA analysis using IMPLAN input-output models (for each state and nationally) (NMA, p. 7 and Appendix A).

9. Spin-offs in mining states (Montana and Wyoming) are estimated based on NMA estimates for spin-offs in those states. Spin-offs in all US are estimated based on NMA estimated multiplier (1 direct mining job supports 2.52 spin-offs jobs in all US (NMA, pp. iii, 8-9). Spin-offs in other states (besides Montana and Wyoming) are estimated as follows: Spin-offs in all US minus spin-offs in mining states (Montana and Wyoming).

[458] NMA Study, pp. 3 (Table 1), 47, 71.

[459] NMA Study, Table 1, p. 3.

[460] As explained in Section 10.5.5, coal exported via the Project would typically be produced at large Powder River Basin surface mines, which have similar characteristics in both states. And as explained in Section 10.5.6, Montana Powder River Basin mines (notably the Spring Creek Mine analyzed in the BBER study) are located close to the Wyoming border.

[461] The NMA and CEE Studies estimate mining jobs from exports based on tonnage of exports as a proportion of total statewide coal production; the BBER Study estimates mining jobs from exports based on tonnage of exports as a proportion of existing Spring Creek Mine production:

- NMA, pp. 3 and especially 8:

  For each state, the analysis assumes that the percentage of direct coal mining employment related coal exports is equal to the percentage of that state's production that is exported abroad.

- CEE, pp. 61-62, 112-116: Job impacts are estimated for export volumes (25, 50, and 100 MMst) based on export volume as a percentage of total Wyoming coal production in 2012; "no economies or diseconomies of scale are assumed with respect to additional production" (p. 62).

- BBER, p. 11: Based on Spring Creek operations in 2011 (311 employees and on-site contractors producing 19.1 MMst), the BBER Study estimates 326 direct mining jobs (including contractors) for 20 MMst additional production.

[462] It is also possible that Millennium operations could potentially alter the export of US coal from the East and Midwest (in addition to Western US production), although any such impacts are likely to be small. Depending on market conditions, some US thermal coal has been and could be exported to Asian markets (especially India, but also including South Korea) via ports on the East and Gulf Coast (see Sections 4.6, 7.5.2, and **Error! Reference source not found.**). The coal exported via these port a lternatives may include some Western US production (notably from Powder River Basin). But these exports will be more typically from US coal production in the East and Midwest (notably Appalachia and Illinois Basin) that is proximate to ports on the East and Gulf Coast. Hence, it is possible that Millennium could result in some incremental exports of Western US production (notably from Powder River Basin) that would displace other US coal production and exports (i.e., US coal production in the East and Midwest (notably Appalachia and Illinois Basin) that (absent Millennium) would have been exported via ports on the East and Gulf Coast). And to the extent that Millennium does alter which US coal production is exported, this will not increase overall US mining jobs and would more likely result in a net decrease. The coal production that would be exported via Millennium (Western US production, notably from large Powder River Basin surface mines) is much less labor-intensive the than coal production exported via East Coast and Gulf Coast ports (production in the East and Midwest, with a large component of smaller and underground mines). As estimated in the NMA Study (pp. ii), Western coal production (West of the Mississippi River) results in only 8% as many direct jobs per ton as coal production east of the Mississippi River. Hence, if Millennium shifts any coal exports and coal production from east to west, this will reduce overall US mining jobs.

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Professional Profile

Ian Goodman is President and founder of The Goodman Group, Ltd. For over 40 years, he has conducted research and consulted in energy regulation and economics (related to conventional, unconventional and renewable energy, and energy efficiency). His practice has addressed a broad range of issues, including pipeline economics and regulation, evolving North American oil, gas and electric markets, and economic development and environmental impacts of various energy supply and transportation options. Since 2011, his practice has focused on supply of fossil fuels (notably shale oil and gas, Canadian tar sands and coal) and fossil fuel transportation logistics (including pipelines, rail and transloading facilities). Mr. Goodman has co-authored reports and expert testimony on the most controversial pipeline projects in North America. He also has expertise in the planning and operations of energy systems, as well as interjurisdictional energy trade in North America.

He has provided expert evidence in over 50 regulatory, environmental assessment, and legal proceedings in various North American jurisdictions including California, Washington, Colorado, North Dakota, South Dakota, New York, New Jersey, three New England states, Florida, British Columbia, Manitoba, Ontario, Quebec and before the Federal Energy Regulatory Commission (FERC) in the US and National Energy Board (NEB) in Canada. He has also assisted counsel in those and other proceedings. His clients include governments, regulators, environmental and customer groups, Indigenous organizations and energy sector companies (electric and gas utilities, marketers, project developers, and equipment providers). Mr. Goodman is the author or co-author of over 60 publications and major reports relating to the energy industry. Ian Goodman co-authored an influential and widely publicized study on the employment impacts of the Keystone XL pipeline ("Pipe Dreams? Jobs Gained, Jobs Lost by the Construction of Keystone XL").

Professional Experience

1989 – present President, The Goodman Group, Ltd., Berkeley, California (formerly Boston, Massachusetts)

Collaborating with a team of associates to provide expert consulting services such as expert testimony, reports, research, policy assessment and litigation support related to energy regulation and economics (conventional, unconventional and renewable energy, and energy efficiency).

Specializing in pipeline economics and regulation, evolving North American oil, gas and electric markets, economic development and environmental impacts of various energy supply options and transportation logistics, and energy system planning and operations.

Major Projects:

Economic and Environmental Impacts of Energy Options and Systems

- Since 1991, has conducted or co-authored over 50 national, regional, and state/provincial studies on the economic and environmental impacts of various energy options, infrastructure and systems throughout the US and Canada.

- Since 2011, has co-authored 14 expert reports on the economic and environmental impacts of crude oil and natural gas production and transportation (particularly shale and tar sands crude production, interjurisdictional pipelines and crude by rail projects).

- Co-authored the "Expert Report on the Northeast Supply Enhancement (NESE) Project Economic Impact Analysis for New Jersey, New York and Pennsylvania" with Brigid Rowan, commissioned by the Eastern Environmental Law Center (EELC). This May 2018 report evaluates the economic impact study (Economic Impacts of the Proposed Northeast Supply Enhancement in New Jersey, Pennsylvania and New York) prepared for the Transcontinental Gas Pipe Line Company, LLC (Transco) by Michael Lahr and Will Irving of Rutgers University.

  TGG's evaluation demonstrates that the Rutgers Analysis substantially overstates the jobs from building the Project. The Rutgers Analysis overstates construction jobs in the tri-state area by 70-80%. Moreover, pipeline operations result in very small expenditures (and employment impacts) and have very little positive effect on the economy. The expert report was submitted at FERC in May 2018 by the Eastern Environmental Law Center (EELC) on behalf of NY/NJ Baykeeper, Food & Water Watch et al, as part of Intervenors' Additional Comments On FERC's March 2018 Draft Environmental Impact Statement For The Northeast Supply Enhancement Project.

- Authored a Declaration regarding a review of the environmental and economic impacts of a proposed methanol production plant at Port of Kalama (the Project) in Washington. The Declaration discusses the failure of the Final Environmental Impact Statement for the Project to adequately consider GHG emissions associated with the Project, as well as a number of other potential environmental and economic impacts. The Declaration of Ian Goodman was filed in August 2017 as part of a legal brief by Earthjustice before the Shorelines Hearings Board for the State of Washington on behalf of Columbia Riverkeeper, Sierra Club and Center for Biological Diversity.

- Authored a Declaration on behalf of the Standing Rock Sioux Tribe concluding that a shutdown of the Dakota Access Pipeline, pending the completion of a new environmental review, (a) would not have the severe disruptive consequences claimed by the pipeline company; (b) would not unduly harm crude producers, refiners, consumers and the US economy; (c) would (at most) result in a relatively limited increase in crude by rail; and (d) would not have significant adverse impacts in regard to risk of accidents/spills. The Declaration of Ian Goodman was filed on August 7, 2017 to support an extensive legal brief by Earthjustice before the United States District Court for The District Of Columbia. This brief is part of Earthjustice's litigation on behalf of Standing Rock Sioux Tribe on the Dakota Access Pipeline.

- Co-authored written Expert Testimony on the Need for the Vancouver Energy Distribution Terminal (VEDT) and a Technical Appendix on the Market Analysis Underlying the Need for the VEDT with Brigid Rowan. The expert report was filed in May 2016 before the State of Washington Energy Facility Site Evaluation Council on behalf of Earthjustice. The testimony concludes that the VEDT will do little if anything to supply Washington with energy. Consequently, there is no economic need for this Project to supply the state.

  The testimony also shows that the VEDT is likely not in Washington's public interest. TGG's cross-jurisdictional study of the costs and benefits of energy logistics facilities for host jurisdictions consistently concludes the following: the benefits are relatively small; the cost/risks are relatively large; and the economic benefits and costs/risks tend to be unevenly distributed (across stakeholders and regions), with the project proponents getting the majority of the benefits and the hosting jurisdiction bearing the majority of the costs/risks.

- Video of oral direct testimony of Ian Goodman; Morning Day 13 (7/19/16) of the VEDT hearings
- Video of oral cross-examination of Ian Goodman; Afternoon Day 13 (7/19/16) of the VEDT hearings.

- Co-authored the "Expert Report on the PennEast Pipeline Project Economic Impact Analysis for New Jersey and Pennsylvania" with Brigid Rowan, commissioned by the New Jersey Conservation Foundation. This November 2015 report evaluates the economic impact study (PennEast Pipeline Project Economic Impact Analysis) prepared for the PennEast Pipeline Company. The PennEast Analysis claims that the pipeline project to transport Marcellus shale natural gas from Pennsylvania to New Jersey would have considerable economic benefits in both states. Goodman and Rowan demonstrate that the PennEast Analysis significantly overstates the total jobs from designing and building the pipeline by approximately two thirds or more. This expert report was submitted at FERC in November 2015 and in September 2016 by the New Jersey Conservation Foundation (NJCF).

- Co-authored written expert testimony, entitled "Changes to the Economic Costs and Benefits of the Keystone XL Pipeline for South Dakota" with Brigid Rowan. The testimony filed in April and June 2015 at the South Dakota Public Utilities Commission on behalf of the Rosebud Sioux Tribe and withdrawn in July 2015. Based on the conclusions of pipeline safety expert, Richard Kuprewicz, Rowan and Goodman estimate a range of Worst-Case Scenario Costs starting at US$1 billion and escalating to $2 billion or more for a very high consequence event. Given the Keystone XL's very small employment and property tax benefits, TGG concludes that, under a range of worst-case scenarios, the costs of the Project will greatly exceed the benefits for South Dakota.

- Co-authored the "Economic Costs and Benefits of the Trans Mountain Expansion Project (TMX) for BC and Metro Vancouver" with Brigid Rowan in collaboration with Simon Fraser University's Centre for Public Policy Research. The report, released in November 2014 and re-released in February 2015, refutes Kinder Morgan's claims regarding the positive economic development benefits of its controversial pipeline project. Goodman and Rowan show that the benefits of the pipeline are very small and have been significantly overstated by Kinder Morgan, whereas the worst-case costs of a catastrophic spill are very large and have been vastly understated. This expert report was filed with the Canadian National Energy Board on July 2015 by North Shore No Pipeline Expansion (NSNOPE).

- Co-authored the "Economics of Transporting and Processing Tar Sands Crudes in Quebec" with Brigid Rowan in collaboration with Équiterre and Greenpeace Canada. The January 2014 report demonstrates that the economic development benefits for Quebec of moving and refining tar sands crudes would be insignificant while the costs and risks are very high.

- Co-authored an "Analysis of the Potential Costs of Accidents/Spills Related to Crude by Rail" with Brigid Rowan on behalf of Oil Change International (OCI). The November 2013 report demonstrates that the economic costs of crude by rail accidents can be very large and concludes that a major crude by rail (CBR) unit train accident/spill could cost $1 billion or more for a single event. The report was incorporated into Comments filed by NRDC, Sierra Club and OCI before PHMSA as part of the Advance Notice of Proposed Rulemaking Hazardous Materials: Rail Petitions and Recommendations To Improve the Safety of Railroad Tank Car Transportation, December 5, 2013.

- Co-authored expert testimony, entitled "The Relative Economic Costs and Benefits of Enbridge's Line 9B Reversal and Line 9 Capacity Expansion Project" with Brigid Rowan. The expert report was filed in August 2013 at Canada's National Energy Board on behalf of the Équiterre Coalition, a coalition of Quebec- and Ontario-based environmental groups. In light of pipeline safety expert, Richard Kuprewicz's high-risk assessment for rupture on the Project, Goodman and Rowan demonstrate that due to Line 9B's extraordinary proximity to people, water and economic activity, the rupture costs of the Project (under a wide variety of pipeline accident/spill possibilities) range from significant to catastrophic. They conclude that the potential economic costs could exceed (and, under a wide range of accident/spill conditions, greatly exceed) the potential economic benefits.

- Co-authored "Comments on Initial Study/Mitigated Negative Declaration (IS/MND) Valero Crude by Rail Project Benicia, California" with Brigid Rowan on behalf of NRDC. The July 2013 report provides a Market Analysis of a proposed crude by rail project for the Valero Benicia Refinery. Goodman and Rowan conclude that the proposed project could significantly affect crude supply (and thus quality) for the refinery, and recommend that a full Environmental Impact Report be undertaken. The report was included as an attachment to NRDC's Comments on Notice of Intent to Adopt a Mitigated Negative Declaration for the Valero Crude by Rail Project, filed with the City of Benicia on July 1, 2013.

- Co-authored a "Report evaluating the adequacy of the Keystone XL (KXL) Draft Supplemental Environmental Impact Statement (DSEIS) Market Analysis" with Brigid Rowan, and filed as an attachment to the Comments on KXL DSEIS jointly submitted by the Sierra Club, NRDC, and 14 other environmental and public interest organizations in April 2013. Based on their evaluation of the early 2013 market conditions (including emerging crude markets, factors driving tar sands expansion, availability and cost of crude oil transportation, and tar sands breakeven costs), Rowan and Goodman concluded that (i) the US State Department's DSEIS Market Analysis was deeply flawed and not a sound basis for decision-making; and (ii) KXL, and specifically its impact on tar sands logistics costs and crude prices, would have a significant impact on tar sands expansion under a very broad range of conditions and assumptions.

- Co-authored an influential and widely publicized study of the Keystone XL pipeline employment impacts ("Pipe Dreams? Jobs Gained, Jobs Lost by the Construction of Keystone XL") with Brigid Rowan and the Cornell Global Labor Institute. The report was released in September 2011 and updated in January 2012. Goodman and Rowan provided the economic analysis to demonstrate that TransCanada Pipelines Ltd had greatly exaggerated the employment impacts of the Keystone XL (KXL) Project. TGG estimated the Project would create no more than 2,500-4,650 temporary direct construction jobs for two years and at the most a handful of permanent jobs (ranging from a low of 20 to a high of 127). TGG's conclusions in Pipe Dreams were used to demonstrate to the US media and to the Obama Administration that KXL would not be a major job creator for the US, nor would it have any substantial impact on US unemployment.

- Co-authored "Employment Impacts of Air-Pollution Controls at North Dakota Coal Plants" with Brigid Rowan. This November 2011 study for Sierra Club National estimated the employment impacts of Air-Pollution Controls at North Dakota Coal Plants.

- Provided expert testimony on behalf of The Greenlining Institute on economic development impacts (focusing on job creation and stimulus) of capital expenditures and rate increases proposed by the Pacific Gas & Electric Company in its 2011 General Rate Case.

- Co-authored the Avoided Energy Supply Costs in New England: 2009 Report, prepared for Avoided-Energy-Supply-Component (AESC) Study Group, which represents all major electric and gas utilities in New England, as well as efficiency program administrators, state energy offices and regulators. TGG's contribution to this report was an analysis of the economic development impact of Massachusetts electricity and gas energy efficiency programs.

- Co-developed E^{3}AS (Energy, Economic, and Environmental Analysis System) software on behalf of the US EPA in 1996 and made it available to assist government agencies in evaluating the economic and environmental impacts of energy supply and efficiency programs, and in considering both the benefits and costs of energy alternatives. Has incorporated E^3AS model analysis in studies of economic and environmental impacts since 1996.

Manitoba Hydroelectric System Planning, Operations, Project Assessment, and US Exports

Wuskatim Generating Station and Transmission Project (1999-2005)

On behalf of the Pimicikamak Cree Nation (PCN):

- Evaluated Manitoba Hydro system planning, environmental review, and disclosure relating to the Churchill-Nelson hydro project
- Assessed the environmental and other impacts from existing hydro and the proposed 200 MW Wuskwatim hydro project
- Analyzed the need for comprehensive assessment of the entire Churchill-Nelson project (existing, proposed, and future)
- Reviewed precedents regarding comprehensive assessment of existing major hydro projects
- Submitted comments to the Minnesota Public Utilities Commission on Northern States Power's supply requirements in relation to Manitoba energy exports from Wuskatim.

Conawapa Generating Station (1990, 1992)

On behalf of a coalition of citizens', conservation and environmental groups: expert evidence in the 1992 Conawapa Project Environmental Assessment concerning:

- the need for environmental reviews to evaluate the justification of design alternatives to the 1290 MW Conawapa hydro project
- a description of the changes in the utility industry and new supply source options affecting the design alternatives included in an environmental review
- a review of the treatment of the project justification in North American environmental assessments.

- Filed expert evidence before the Manitoba Public Utilities Board in the context of the 1990 Manitoba Hydro Submission for the Conawapa generating station, which included:
    - a review of the Manitoba Hydro submission; a review of Manitoba Hydro load forecasting; an estimation of economic and attainable conservation potential; development of principles of conservation program design and delivery; a critique of the utility's proposed demand-side management program, an evaluation of supply-side alternatives and analysis of avoided costs; an assessment of employment and economic development effects of hydroelectric

development and conservation; and an analysis of profitability and risks of the proposed power sales contracts.

Hydro-Québec System Planning, Operations, Project Assessment, and US Exports

Great Whale Project (1989-1994)

Submitted evidence and testified before various regulatory and legal bodies in the US and Canada on behalf of the Grand Council of the Crees (of Québec) and/or a coalition of environmental groups to assess the economic and environmental impacts of the proposed 3160 MW Great Whale Project, as well as the long-term US export contracts based on the project.

Mr. Goodman's wide-ranging efforts were instrumental in Hydro-Québec's eventual cancellation of the Great Whale Project. Key interventions included:

- Submitting evidence between 1989 and 1991, before the Vermont Public Service Board, including a review of a proposed thirty year, 450 MW purchase by twenty-four Vermont utilities of Hydro-Québec power derived from the development of the Great Whale Project; and an analysis of planning and operation of Hydro-Québec power supply and modeling of hydro reservoir levels.

- Testifying in 1991 before the State of Vermont Supreme Court regarding the same 450 MW purchase and providing a summary of changes concerning load forecasts and supply-side alternatives and an analysis of the cost effectiveness of the contract.

- Submitting an analysis of the nexus between New York Power Authority purchases and the construction of specific Hydro-Québec facilities (notably Great Whale), as well as the operation of fossil fuel electric generation before the State of New York Supreme Court in 1990.

- Presenting a review of Hydro-Québec's proposed export contracts to Vermont (450 MW) and New York State (1000 MW) before Canada's National Energy Board in 1990.

- Analyzing confidential risk-sharing electric supply contracts between Hydro-Québec and large industrial customers, including an assessment of the resulting implications for Hydro-Québec and its ratepayers in 1991.

- Submitting evidence in 1992 for the Canadian and Québec governments' Environmental Review of the Great Whale Project including a discussion of changes in the utility industry and new supply resource options affecting design alternatives included in an environmental review.

- Assessing an 800 MW seasonal diversity contract in the context of the 1994 energy market before the State of New York Assembly Standing Committees on Energy and Conservation.

1986 – 1989 Consulting Associate, PLC, Inc., Boston, Massachusetts

Research and consulting in various aspects of utility regulation and economics. Advised utilities and regulatory commissions on electric and gas least-cost planning. Assessed potential for conservation, non-utility generation, and other supply alternatives. Reviewed prudence of power supply investment decisions. Analyzed rate design and allocation issues. Developed end-use demand estimates. Evaluated district heating system management. Analyzed markets and rates of regulated transportation services.

1981 – 1986 Consulting Associate, Analysis and Inference, Inc., Boston, Massachusetts

Research and consulting in various aspects of utility regulation and statistical applications. Reviewed prudence of utility power plant construction programs with emphasis on cost and schedule of nuclear plants. Researched utility rate design and allocation issues. Reviewed demand forecasts. Analyzed taconite industry economics and electricity supply. Analyzed causal factors for statistical theft estimation of fuel oil overbilling and diversion of parking meter and transit revenue.

1978 – 1987 Consultant, Salgo & Lee, Boston, Massachusetts

Research and consulting in electric utility regulation and civil damage litigation. Reviewed nuclear construction programs and alternatives, demand forecasts, transmission line proposals, and state rate-making policies. Analyzed effects of regional power pool rules on independent power producers. Evaluated damage claims arising from power plant equipment outages.

Education

1977	S.B., Civil Engineering, Massachusetts Institute of Technology

Advisory Assignments to Regulatory and Investigatory Commissions and Staff

1996	Commission of Inquiry on Hydro-Québec's Purchase Policy for Electricity from Independent Power Producers (*Commission d'enquête sur la politique d'achat par Hydro-Québec d'électricité auprès de producteurs privés*), Commission Staff.
1993 – 2000	Maine Public Utilities Commission Staff, Docket Nos. 92-331, 95-598, 98-791, 2000-441, and 2000-47; Special Industrial Rate Contracts
1993	Maine Public Utilities Commission Staff, Docket No. 93-147; Certificate of Public Convenience to Erect a Transmission Line
1987 – 1988	District of Columbia Public Service Commission, Docket No. 834 Phase II; Least-cost Planning Procedures and Goals.

Appointments

1991 – 1995	Committee to Review the Glen Canyon Environmental Studies, National Research Council Water Science and Technology Board
1978	New England Energy Congress, Regulatory and Institutional Process Committee.

Publications and Major Reports

Expert Report on the Northeast Supply Enhancement (NESE) Project Economic Impact Analysis for New Jersey, New York and Pennsylvania, commissioned by the Eastern Environmental Law Center (EELC), *May 14, 2018* (co-author with Brigid Rowan). This expert report was submitted at FERC in May 2018 by the Eastern Environmental Law Center (EELC) on behalf of NY/NJ Baykeeper, Food & Water Watch et al.

Expert Report on the PennEast Pipeline Project Economic Impact Analysis for New Jersey and Pennsylvania, commissioned by the New Jersey Conservation Foundation, *November 4, 2015* (co-author with Brigid Rowan). This expert report was submitted at FERC in November 2015 and in September 2016 by the New Jersey Conservation Foundation (NJCF).

Comments on Scoping Supplemental Environmental Impact Statement (SEIS) Rulemaking for Colorado Roadless Coal Exception #46470 to the U.S. Department of Agriculture Forest Service on behalf of the Sierra Club, *May 22, 2015* (co-author with Brigid Rowan).

Comments on Draft Environmental Impact Report (DEIR) Analysis of Oil and Gas Well Stimulation Treatments in California on behalf of NRDC, *March 16, 2015* (co-author with B. Rowan), incorporated as an attachment to Comments filed by Natural Resources Defense Council (NRDC), Center for Biological Diversity (CBD), Sierra Club, Los Angeles Waterkeeper on the Department of Conservation's, through its Division of Oil, Gas and Geothermal Resources (DOGGR), Draft Environmental Impact Report (DEIR) for Well Stimulation in California (the Project) prepared pursuant to the California Environmental Quality Act (CEQA).

Economic Costs and Benefits of the Trans Mountain Expansion Project (TMX) for BC and Metro Vancouver in collaboration with The Centre for Public Policy Research, Simon Fraser University, *November 10, 2014* (co-author with B. Rowan, re-released *February 4, 2015*). This expert report was filed with the Canadian National Energy Board on July 2015 by North Shore No Pipeline Expansion (NSNOPE).

Report on the Economics of Transporting and Processing Tar Sands Crudes in Quebec in collaboration with Équiterre and Greenpeace Canada, *January 2014* (co-author with B. Rowan).

Analysis of the Potential Costs of Accidents/Spills Related to Crude by Rail, *November 8, 2013* (co-author with B. Rowan) on behalf of Oil Change International (OCI), incorporated as Attachment 3 to Comments filed by NRDC, Sierra Club and OCI before The Pipeline and Hazardous Materials Safety

Administration, U.S. Department Of Transportation as part of the Advance Notice of Proposed Rulemaking Hazardous Materials: Rail Petitions and Recommendations To Improve the Safety of Railroad Tank Car Transportation, *December 5, 2013*.

Comments on Initial Study/Mitigated Negative Declaration (IS/MND) Valero Crude by Rail Project, Use Permit Application 12PLN-00063, Benicia, California, *July 1, 2013* (co-author with B. Rowan) on behalf of NRDC, included as an attachment to NRDC's Comments on Notice of Intent to Adopt a Mitigated Negative Declaration for the Valero Crude by Rail Project, filed with the City of Benicia Community Development Department on *July 1, 2013*.

Report evaluating the adequacy of the Keystone XL (KXL) Draft Supplemental Environmental Impact Statement (DSEIS) Market Analysis, *April 22, 2013* (co-author with B. Rowan), filed as an attachment to the Comments on KXL DSEIS jointly submitted by the Sierra Club, NRDC, and 14 other environmental and public interest organizations.

Pipe Dreams? Jobs Gained, Jobs Lost by the Construction of Keystone XL, *September 28, 2011* (co-author with B. Rowan, TGG, and L. Skinner and S. Sweeney, Cornell Global Labor Institute; *revised January 18, 2012*).

Employment Impacts of Air-Pollution Controls at North Dakota Coal Plants, prepared for Sierra Club, *November 21, 2011* (co-author with B. Rowan).

The Economics of Supplier Diversity Examining Areas of Potential Interest for GLI with respect to GRC 2011 and Potential Amendments to GO 156, prepared for The Greenlining Institute, *August 6, 2010* (co-author with B. Rowan).

Avoided Energy Supply Costs in New England: 2009 Report, prepared for Avoided-Energy-Supply-Component (AESC) Study Group, *August 21, 2009* (co-author with R. Hornby, P. Chernick, et al.; *revised October 23, 2009*).

Reallocation of Funds from National Grid's Current Energy Efficiency Programs to Other Uses, prepared for National Grid USA, *October 24, 2006*

National Grid's Energy Efficiency Programs: Benefits for Rhode Island's Economic Development and Environment, prepared for National Grid USA, *July 28, 2006*.

Comment of Pimicikamak Cree Nation (PCN) on Minnesota Draft State Energy Planning Report, sponsored by Minnesotans for an Energy-Efficient Economy (ME3), *November 21, 2001.*

Proposal for PV and Energy Efficiency at State Facilities: Benefits for California's Economic Development and Environment, prepared for PowerLight Corporation, *November 15, 2001.*

Narragansett Electric's Energy Efficiency Programs: Benefits for Rhode Island's Economic Development and Environment, prepared for Narragansett Electric Company, *August 14, 2001.*

Comment Submitted By Pimicikamak Cree Nation on An Investigation Into Environmental And Socio-Economic Costs Under Minnesota Statute §216B.2422, Subd. 3, submitted in Minnesota Public Utilities Commission Docket No. E999/CI-00-1636, *January 16, 2001* (co-author with P. Chernick and A. Orkin).

Comment Submitted By Pimicikamak Cree Nation on Northern States Power's 1999 Request for Proposals for Supply Resources Needed Starting 2001-2005, submitted in Minnesota Public Utilities Commission Docket No. E002/M-99-888, *March 1, 2000,* Supplemental Comment *August 18, 2000* (co-author with R. McCullough, A. Orkin, A. Stewart, et al.).

Analysis of Special Industrial Rate Contracts: Maine Public Service Company with McCain Foods (Docket 2000-441) and J.M. Huber (Docket 2000-47), prepared for Maine Public Utilities Commission Staff, *July 2000.*

Energy, Economic, and Environmental Analysis System (E3AS) User's Guide: Version 2, prepared for the US Environmental Protection Agency, *July 1998* (co-author with R. Carlson and B. Krier).

Employment, Earnings, and Environmental Impacts of Regional Improvements in Energy Efficiency, the Southern States Energy Board, *December 23, 1996* (co-author with B. Krier and P. Kelly-Detwiler).

North Carolina State Energy Supply Plan for Use with E3AS, prepared for North Carolina Department of Commerce Energy Division, *November 27, 1996* (co-author with R. Carlson).

Energy, Economic, and Environmental Analysis System (E3AS) User's Guide, prepared for the Southern States Energy Board, *May 1996* (co-author with R. Carlson and B. Krier).

Preliminary Results of Mohave Competitiveness Analysis, prepared for the Hopi Tribe, *March 11, 1996.*

River Resource Management in the Grand Canyon, Committee to Review the Glen Canyon Environmental Studies, National Research Council Water Science and Technology Board (Washington: National Academy Press, *1996*) (co-author with W. Lewis, et al.).

Submission of the Grand Council of the Crees (of Québec) and the Cree Regional Authority, Addressed to the Consultation of the Public Debate on Energy: Complement, prepared for Grand Council of the Crees (of Québec), *August 1995* (co-author with P. Raphals, et al.).

"Energy Efficiency and Employment: Recent Findings and Directions for Future Research," Third International Energy Efficiency & DSM Conference: Charting the Future, (Bala Cynwyd: SRC International, *1994*) (co-author with B. Krier).

"A Win/Win Approach to Commercial/Industrial DSM: Making DSM Work for All Utility Customers," The Electricity Journal, Vol. 7, No. 9, *November 1994* (co-author with H. Lachman, P. Cillo, and P. Kelly-Detwiler).

Conformity Analysis of Hydro-Quebec's Great Whale Project Feasibility Study, prepared by the Great Whale Environmental Assessment Office of the Grand Council of the Crees (of Québec)/Cree Regional Authority in consultation with Environmental Economics Intl., et al., *July 1994* (co-author with R. Torrie, et al.).

"DSM as Economic Development Strategy," The Electricity Journal, Vol. 7, No. 4, *May 1994* (co-author with S. Laitner and B. Krier).

Review of the Draft Environmental Impact Statement on Operation of Glen Canyon Dam, Committee to Review the Glen Canyon Environmental Studies, National Research Council Water Science and Technology Board (Washington: National Academy Press, *April 1994*) (co-author with W. Lewis, et al.).

Review of the Draft Federal Long-Term Monitoring Plan for the Colorado River Below Grand Canyon Dam, Committee to Review the Glen Canyon Environmental Studies, National Research Council Water Science and Technology Board (Washington: National Academy Press, *1994*) (co-author with W. Lewis, et al.).

A Comparison of New York State Employment Impacts from Expanded Demand-Side Management and Hydro-Québec Imports, prepared for Greenpeace USA, *February 16, 1994* (co-author with B. Krier and P. Kelly-Detwiler; *revised March 1, 1994*).

Employment Impacts of Electricity Efficiency in Florida, prepared for the Florida Energy Office, *November 18, 1993* (co-author with B. Krier and P. Kelly-Detwiler).

Economic Analysis of Mohave Generating Station Gas Conversion, prepared for the Alternative Coal Transport Study, Economic Analysis for the Hopi Tribe, *September 13, 1993.*

The Impact of Increased Coal Transportation Costs Upon Mohave Generating Station Customers, prepared for the Alternative Coal Transport Study, Economic Analysis for the Hopi Tribe, *July 27, 1993.*

Track II Position Paper on Behalf of the Grand Council of the Crees (of Québec) and PROTECT, submitted in New York Public Service Commission Case 92-E-1187 (Concerning Incorporation of Environmental Costs into Long-run Avoided Costs), *June 25, 1993* (co-author with J. Dumont and P. Kelly-Detwiler).

Review of the 1993 Hydro-Québec Development Plan, submitted to Québec Parliamentary Commission on the Economy and Employment, prepared for Grand Council of the Crees (of Québec), *March 11, 1993* (co-author with P. Kelly-Detwiler and E. Titus; also available in French as Analyse Critique du Plan de Développement 1993 d'Hydro-Québec).

Assessment of the Requirement and Rationale for Transmission Facilities Associated with the 1000 MW Electricity Purchase from Manitoba Hydro, submitted in Ontario Environmental Assessment Board Ontario Hydro Demand/Supply Plan Hearing, on behalf of Nishnawbe-Aski Nation/Grand Council Treaty #3/Teme-Augama Anishnabai, *December 1992.*

Economic Evaluation of Ontario Hydro's Proposed Moose River Basin Hydroelectric Projects, submitted in Ontario Environmental Assessment Board Ontario Hydro Demand/Supply Plan Hearing, on behalf of the Moose River/James Bay Coalition, *December 1992* (co-author with R. Carlson, R. McCullough, and W. Huddleston).

Energy Efficiency: Opportunities for Employment, prepared for Greenpeace U.K./International, *November 11, 1992* (co-author with B. Krier).

"Electricity Generation and Greenhouse Gases," Planning Our Electric Future Now, Conference Proceedings of Canadian Electric Association, *November 1992.*

Comments of Pace Energy Project; Natural Resources Defense Council, National Audubon Society; Vladeck, Waldman, Elias and Englehard; Environmental Defense Fund; Environmental Planning Lobby on the 1993-1994 Annual and Long Range Demand-Side Management and Integrated Resource Plans of the New York Utilities, submitted in New York Public Service Commission Case No. 28223, *September 14, 1992* (co-author with A. Gupta, J. Tripp, J. Vladeck, D. Wooley, et al.).

Employment Effects of Electricity Provision in Québec: The Great Whale Hydroelectric Project and Electricity Efficiency Alternative, prepared for Grand Council of the Crees (of Québec), *June 16, 1992* (co-author with B. Krier and M. Clark; *revised November 5, 1992;* abbreviated James Bay Publication Series version November 1994; full version and abbreviated versions also available in French as Effets de la fourniture d'électricité sur l'emploi au Québec: le projet d'aménagement hydroélectrique Grande Baleine et la solution de rechange axée sur l'efficacité énergétique).

A Comparison of the Employment Creation Effects of the AES-Harriman Cove Coal-Fired Generating Station and Maine Demand-Side Management, prepared for Conservation Law Foundation and National Resources Council of Maine, *May 15, 1992* (co-author with M. Clark, P. Kelly-Detwiler, and M. Anthony).

A Review of the Report on Gas Integrated Resource Planning for Submission to the Ontario Energy Board, on behalf of Ontario Metis and Aboriginal Association, *February 28, 1992* (co-author with B. Morse, M. Watkins, J. Stevenson, P. Kelly-Detwiler, and M. Clark).

"Electricity Imports from Quebec: The Current and Historical Context," Northeast Indian Quarterly, *Winter 1991.*

The Role of Non-utility Generation in Vermont, *December 12, 1991* (co-author with P. Messerschmidt).

Economic and Employment Impacts of Vermont State Energy Options, prepared for Northeast Alliance to Protect James Bay, *November 7, 1991* (co-author with P. Kelly-Detwiler and M. Anthony).

Comments on the Draft New York State Energy Plan 1991 Biennial Update, on behalf of PROTECT, Hudson Sloop Clearwater, and Grand Council of the Crees (of Québec), *October 7, 1991.*

"Energy Conservation vs. the James Bay Hydroelectric Project," Canadian Water Watch, Vol. 4, No. 5, *June 1991.*

Employment Impacts of New York State Energy Options, prepared for Grand Council of the Crees (of Québec), *June 2, 1991* (co-author with M. Tennis and M. Clark).

Comments on the Determination of the Supply Resources and Environmental Effects Affiliated with Ontario Hydro Proposed Export Sales, submitted in Canadian National Energy Board Order No. EW-3-90, on behalf of Moose River James Bay Coalition / Nishnawbe-Aski Nation / Grand Council Treaty No. 3, *January 28, 1991* (co-author with P. Kelly-Detwiler).

Comments of Sierra Club, Inc.; Atlantic States Legal Foundation, Inc.; PROTECT; and Grand Council of the Crees (of Québec) on Issues to be Addressed in the New York State Energy Planning Report 1991, *January 2, 1991* (co-author with P. Messerschmidt).

"Analysis of Residential Fuel-Switching as an Electric Conservation Option," Gas Energy Review, Vol. 18, No. 12, *December 1990* (co-author with P. Chernick and E. Espenhorst).

Comments of Center for Environmental Legal Studies; Natural Resources Defense Council, National Audubon Society; Vladeck, Waldman, Elias and Englehard; Environmental Defense Fund on the 1991-1992 Annual and Long Range Demand-Side Management Plans of the Major Electric Utilities, submitted in New York Public Service Commission Case No. 28223, *September 28, 1990* (co-author with J. Plunkett, et al.).

"Hydro-Québec's Long-Term Export Policy," Canadian Water Watch, Vol. 3, No. 7-8, *July-August 1990.*

Conservation and Capacity Optimization Alternatives to the PGT/PG&E Gas Pipeline Project, Tellus Institute Study No. 90-03, prepared for California Public Utilities Commission, *May 1990* (co-author with R. Hornby, S. Bernow, D. Marron, D. Nichols, D. Singh, and M. Tennis).

Complément Technique au Mémoire du Grand Conseil des Cris (du Québec) à la Commission de l'Économie et du Travail de l'Assemblée Nationale du Québec, prepared for Grand Council of the Crees (of Québec), *April 1990* (co-author with R. Mainville, et al.).

Analysis of Fuel Substitution as an Electric Conservation Option, PLC, Incorporated, prepared for Boston Gas Company, *December 22, 1989* (co-author with P. Chernick and E. Espenhorst).

Conservation Potential in the State of Minnesota, Volumes I and II, PLC, Incorporated, prepared for Minnesota Department of Public Service, *June 27, 1988* (co-author with P. Chernick).

The Excess Capacity Situation of Minnesota Power: Magnitude, Duration, and Origin, PLC, Incorporated, prepared for Minnesota Department of Public Service, *July 20, 1987* (co-author with P. Chernick; *revised August 12, 1987*).

Final Report, Phase I, Module IV, Rate Design/Analysis, Pacific Northwest Electric Power and Conservation Planning Council, *December 1981* (co-author with P. Chernick, S. Finger, and M. Meyer).

Regional and Commodity Price-Indices for the Trucking Industry, M.I.T. Center for Transportation Studies, CTS Report 77-13, *July 1977* (co-author with A. Friedlander)

Expert Testimony and Formal Submissions

Information is presented in the following order: jurisdiction and docket number; title of case; client; date testimony filed; and subject matter covered.

1. **United States Federal Environmental Regulatory Commission (Docket CP17-101-000); on behalf of NY/NJ Baykeeper, Food & Water Watch, Central Jersey Safe Energy Coalition, and Princeton Manors Homeowners Association; May 14, 2018 (co-author with B. Rowan); submitted by the Eastern Environmental Law Center (EELC) as part of Intervenors' Additional Comments On FERC's March 2018 Draft Environmental Impact Statement For The Northeast Supply Enhancement Project.**
   Evaluated the economic impact study (Economic Impacts of the Proposed Northeast Supply Enhancement in New Jersey, Pennsylvania and New York) prepared for the Transcontinental Gas Pipe Line Company, LLC (Transco) by Michael Lahr and Will Irving of Rutgers University. Concluded that the Rutgers Analysis substantially overstates the jobs from building the Project. The Rutgers Analysis overstates construction jobs in the tri-state area by 70-80%. Moreover, pipeline operations result in very small expenditures (and employment impacts) and have very little positive effect on the economy.

2. **Shorelines Hearings Board for the State of Washington (SHB No. 17-010c); Columbia Riverkeeper, Sierra Club and Center for Biological Diversity (Petitioners); August 21, 2017 (with in-depth participation of B. Rowan); in support of Brief filed by Earthjustice on behalf of Petitioners.**
   Reviewed the environmental and economic impacts of a proposed methanol production plant in an industrial park owned by the Port of Kalama (the Project). Discussed the failure of the Final Environmental Impact Statement for the Project to adequately consider GHG emissions associated with the Project, as well as a number of other potential environmental and economic impacts.

3. **United States District Court for The District Of Columbia (Case No. 1:16-cv-1534-JEB); Standing Rock Sioux Tribe, joined by Cheyenne River Sioux Tribe (Plaintiffs); August 7, 2017 (with in-depth participation of B. Rowan); Technical Appendix; August 7, 2017 (with in-depth participation of B. Rowan); in support of Brief filed by Earthjustice on behalf of Plaintiffs.**
   Reviewed the Brief and Declarations filed by Dakota Access, LLC, regarding remedy in this litigation. Concluded that a shutdown of the Dakota Access Pipeline (DAPL), pending the completion of a new environmental review, (a) would not have the severe disruptive consequences claimed by the pipeline company; (b) would not unduly harm crude producers, refiners, consumers and the US economy; (c) would (at most) result in a relatively limited increase in crude by rail; and (d) would not have significant adverse impacts in regard

to risk of accidents/spills. In fact, for the Plaintiffs' reservations, DAPL would have a much higher proximity and much greater risk than does crude by rail. In terms of the risk of worst-case accidents and spills, the Declaration concluded that there is no clear reason to assume that DAPL is less risky than crude by rail.

4. **State of Washington Energy Facility Site Evaluation Council (Case No. 15-001); Application No. 2013-01 of Tesoro Savage LLC Vancouver Energy Distribution Terminal; Earthjustice; May 13, 2016 (with in-depth participation of B. Rowan); Technical Appendix: Market Analysis; May 13, 2016; (co-author with B. Rowan).**
   Evaluation of the economic need for Washington State of the Vancouver Energy Distribution Terminal (VEDT). Demonstrated that the VEDT will do little if anything to supply Washington with energy. Consequently, concluded that there is no economic need for this Project to supply Washington. Analysis of whether the Project is in the public interest of Washington State. TGG's cross-jurisdictional study of the costs and benefits of energy logistics facilities for host jurisdictions consistently concludes the following: the benefits are relatively small; the cost/risks are relatively large; and the economic benefits and costs/risks tend to be unevenly distributed (across stakeholders and regions), with the project proponents getting the majority of the benefits and the hosting jurisdiction bearing the majority of the costs/risks. Recommendation that the Project be rejected based on the conclusion that it is highly likely that the VEDT is not in the public interest of Washington.

5. **United States Federal Environmental Regulatory Commission (Docket No. CP15-558-000); on behalf of New Jersey Conservation Foundation; November 6, 2015 (co-author with B. Rowan); submitted by New Jersey Conservation Foundation as part of its comments October 29, 2015 regarding the PennEast Pipeline Application and resubmitted by the same party on September 8, 2016.**
   Evaluation of the economic impact study (PennEast Pipeline Project Economic Impact Analysis) prepared for the PennEast Pipeline Company. Refuted the PennEast Analysis claims that the pipeline project to transport Marcellus shale natural gas from Pennsylvania to New Jersey would have considerable economic benefits in both states. Demonstrated that the PennEast Analysis significantly overstated the total jobs from designing and building the pipeline by approximately two thirds or more.

6. **Canadian National Energy Board Hearing Order OH-001-2014; Application for Trans Mountain Expansion Project; North Shore No Pipeline Expansion (NSNOPE); July 21, 2015 (joint testimony with B. Rowan).**
   Estimated the economic benefits of the proposed Trans Mountain Expansion Project (TMX) for BC and Metro Vancouver and compares these benefits to a range of potential costs of bad to worst-case scenarios. Provided guidance as

to whether TMX is in the public and economic interest of BC and Metro Vancouver. Refuted Kinder Morgan's claims regarding the positive economic development benefits of its controversial pipeline project. Demonstrated that the benefits of the pipeline are very small and have been significantly overstated by Kinder Morgan (the proponent), whereas the worst-case costs of a catastrophic spill are very large and have been vastly understated.

7. **South Dakota Public Utilities Commission (Docket HP14-001); Petition of TransCanada Keystone Pipeline, LP (Keystone) for Order Accepting Certification of Permit Issued in Docket HP09-001 to Construct the Keystone XL Pipeline; The Rosebud Sioux Tribe; April 24, 2015; Rebuttal Testimony June 26, 2015 (joint testimony with B. Rowan). Testimony withdrawn July 17, 2015.**
   Analysis of the changes to the economic costs and benefits of the Keystone XL Pipeline for South Dakota. Based on the conclusions of pipeline safety expert, Richard Kuprewicz, evaluation of a range of Worst-Case Scenario Costs starting at US$1 billion and escalating to $2 billion or more for a very high consequence event. Given the Keystone XL's very small employment and property tax benefits, concluded that, under a range of worst-case scenarios, the costs of the Project will greatly exceed the benefits for South Dakota.

8. **Canadian National Energy Board Hearing Order OH-002-2013; Enbridge Pipelines Inc. Line 9B Reversal and Line 9 Capacity Expansion Project Application; Équiterre (Coalition); August 8, 2013 (joint testimony with B. Rowan).**
   Analysis of relative economic costs and benefits of Enbridge's Line 9B Reversal and Line 9 Capacity Expansion Project. Evaluation of the Project, which would transport a mix of tar sands dilbit, Bakken, and conventional WCSB crudes through Ontario and Quebec, crossing major waterways and Canada's most populous urban areas, (including Toronto and Montreal). Recommendation that the Enbridge Project be rejected, based on (i) the results of this relative economic cost-benefit analysis, demonstrating that the potential economic costs could exceed (and, under a range of malfunction/accident conditions, greatly exceed) the potential economic benefits; (ii) the highly uneven allocation of costs and benefits among the stakeholders, and across regions; and (iii) the conclusion of international pipeline safety expert, Richard Kuprewicz, that there is a high risk of pipeline rupture in the early years following Project implementation due to a combination of cracking and corrosion.

9. **California Public Utilities Commission Application No. 09-12-020; Pacific Gas & Electric Company General Rate Case 2011; The Greenlining Institute; May 19, 2010; Rebuttal Testimony June 4, 2010.**
   Analysis of economic development impacts (focusing on job creation and stimulus) of PG&E's proposed capital expenditures and associated rate

increases. Consideration of the impacts of these expenditures and rate increases on customers and communities. Recommendation that PG&E increase its supplier diversity activities in order to offset adverse impacts on customers and communities while addressing equity concerns. Analysis of PG&E's Customer Retention and Economic Development (Load Attraction and Retention) activities. Analysis of the direct testimony of other intervenors with respect to economic development impacts of the proposed capital expenditures and quantification of these impacts in the Rebuttal Testimony.

10. **Manitoba Clean Environment Commission Public Registry Files 4724/4725; Wuskwatim Generating Station and Transmission Project; Pimicikamak Cree Nation (PCN); August 8, 2003 (joint affidavit with R. McCullough).**
    Evaluation of Manitoba Hydro system planning, environmental review, and disclosure relating to the Churchill-Nelson hydro project. Consideration of environmental harm and other impacts from existing hydro and proposed 200 MW Wuskwatim project. Analysis of need for comprehensive assessment of the entire Churchill-Nelson project (existing, proposed, and other future). Discussion of precedents regarding comprehensive assessment of existing major hydro projects.

11. **United States District Court, Northern District of New York Case 01-CV-0951; Pogliani, et al. v. Army Corps of Engineers; Stand Together Oppose Power Plant (STOPP); June 29, 2001.**
    Analysis of need for proposed 1080 MW gas combined cycle power plant in Athens, New York. Consideration of locational requirements for supply. Evaluation of potential for other in-state sources and imports.

12. **Vermont Public Service Board Docket 6300; Proposed Sale of Vermont Yankee Nuclear Power Station; New England Coalition on Nuclear Pollution and Vermont Public Interest Research Group; April 14, 2000.**
    Consideration of power supply planning in the context of risk and uncertainly. Evaluation of whether the proposed plant sale is consistent with sound utility planning, regulatory oversight, and electricity restructuring.

13. **Maine Public Utilities Commission Docket 98-791; Bangor Hydro-Electric Company; Maine Public Utilities Commission Staff; May 4 1999 (Bench Analysis joint with A. Monroe and M. Force) .**
    Assessment of request for extension and amendment of special industrial rate. Analysis of the economic and physical viability of paper mill self-generation options. Evaluation of whether the contract extension would be beneficial for other utility ratepayers. Development of recommendations for amended contract termination provisions.

14. **California Public Utilities Commission A. 96-03-031; Southern California Gas Company; The Utility Reform Network (TURN); December 30, 1998;**

Rebuttal Testimony February 26, 1999.
Review of claims by gas utility and other parties that economic development would be promoted by allocating transition costs away from large industrial and other noncore gas customers. Evaluation of how economic development will be impacted by the period selected for amortization of these transition costs. Provision of recommendations regarding consideration of economic development issues by the Commission.

15. **California Public Utilities Commission A. 97-12-048; Southern California Gas Company; The Utility Reform Network (TURN); April 17, 1998; Rebuttal Testimony May 4, 1998.**
Review of claims by gas utility and other parties that economic development would be promoted by allocating transition costs away from large industrial and other noncore gas customers. Provision of recommendations regarding consideration of economic development issues by the Commission.

16. **Ontario Energy Board E.B.O. 177-17; Union Gas Ltd./Centra Gas Ontario, Inc. Application to Transfer Appliance Businesses to Union Energy; Pollution Probe; January 19, 1998.**
Review of gas utilities' proposal to transfer their appliance sales, financing, renting and servicing businesses to an unregulated subsidiary. Evaluation of costs and benefits for gas consumers. Assessment of impacts upon competition, DSM, and the environment. Discussion of precedents regarding large-scale divestiture of utility assets, tender processes, and market-based valuation. Provision of recommendations regarding the future of the appliance businesses and development of competitive markets.

17. **United States Federal Energy Regulatory Commission Dockets ER97-1079-000 and OA97-237-000; New England Power Pool; Grand Council of the Crees (of Québec) and New England Coalition for Energy Efficiency and the Environment; July 1, 1997 (joint affidavit with R. Carlson).**
Review of the market power analysis and market power mitigation principles submitted by New England Power Pool. Development of applicable standard for market power analysis. Evaluation of the potential for exercise of horizontal and vertical market power by Hydro-Québec. Assessment of possible market power mitigation measures.

18. **State of Vermont House Commerce Committee and House Judiciary Committee; April 30, 1997.**
Review of a contract for purchases of Hydro-Québec power by Vermont utilities. Analysis of how changes in load forecasts, supply-side alternatives, and the wholesale power markets affect contract cost-effectiveness. Evaluation of decisions by Vermont utilities and state agencies to approve the contract. Discussion of implications for utility restructuring.

19. **United States Federal Energy Regulatory Commission Docket ER97-851-000; Petition of H.Q. Energy Services (U.S.) Inc. for Order Accepting Initial Rate Schedule, Authorizing Market-Based Rates, and Granting Certain Waivers and Blanket Approvals; Grand Council of the Crees (of Québec) and New England Coalition for Energy Efficiency and the Environment; March 27, 1997; Affidavit August 19, 1997 (joint affidavit with R. Carlson); Supplemental Affidavit September 25, 1997 (joint affidavit with R. Carlson).**
Review of Hydro-Québec subsidiary's request for power marketer status. Assessment of Hydro-Québec transmission tariff and conformity with FERC Transmission Pricing Principles and Order 888. Development of applicable standard for market power analysis and critique of applicant's analysis under traditional Hub-and-Spoke and Merger Policy Statement frameworks. Identification of potential affiliate abuse, anti-competitive behavior, and environmental impacts. Assessment of possible market power mitigation measures. Discussion of reciprocal access to Québec markets.

20. **Massachusetts Department of Public Utilities 96-25; Massachusetts Electric Restructuring Proposal; Wheeled Electric Power Company; November 21, 1996.**
Review of Massachusetts Electric's proposed Restructuring Settlement. Analysis of effects upon the utility's financial position and retail competition. Evaluation of the financial and rate reduction implications of an alternative proposal for Standard Offer retail prices to be market-based, rather than pre-specified.

21. **Commission d'enquête sur la politique d'achat par Hydro-Québec d'électricité auprès de producteurs privés; Commission Staff; September 16, 1996.**
Analysis of Hydro-Québec's cycle of electricity surpluses and sales promotion in domestic and export markets. Evaluation of the relationship between sales promotion and the utility's independent power program. Review of mechanisms used elsewhere to acquire independent power. Discussion of transfer of utility small hydro projects to independent producers.

22. **Ontario Energy Board E.B.R.O. 493/494; Union Gas Ltd./Centra Gas Ontario, Inc. 1997 Rates Hearing; Pollution Probe; September 6, 1996 (joint testimony with R. Carlson).**
Evaluation of the utilities' gas avoided cost methodology, and avoided cost estimates used in their 1997 DSM Plan. Review and verification of the utilities avoided cost analysis. Development of recommendations for future avoided cost submissions.

23. **Ontario Energy Board HR 24; Ontario Hydro 1997 Rate Proceeding; Green Energy Coalition; June 11, 1996 (joint testimony with R. Carlson).**
Examination of social and economic consequences affiliated with Ontario

Hydro's existing and proposed industrial, residential, and commercial optional rates. Specific analysis of load retention/expansion, surplus power, real time, and aggregation rates, with reference to the Board's stated concerns regarding transparency, consideration of environmental impacts, and due diligence to prevent free ridership.

24. **Vermont Public Service Board Docket 5870; Tariff filing of Green Mountain Power requesting authority to implement its Customer Pilot Pricing Program; Grand Council of the Crees (of Québec), New England Coalition for Energy Efficiency and the Environment, and Vermont Public Interest Research Group; March 19, 1996.**
Review of a proposed rate discount for incremental sales to residential and small commercial customers. Analysis of impacts upon sales, energy efficiency, and net revenues. Evaluation of program design, evaluation plan, equity considerations, environmental impacts, and potential for free ridership.

25. **Maine Public Utilities Commission Docket 95-598; Central Maine Power Company's Annual Demand-Side Management Targets; Maine Public Utilities Commission Staff; June 26, 1995 (joint testimony with J. Raab).**
Discussion of the rationale for Central Maine Power Company's continued acquisition of demand-side management resources and the need for utility efficiency programs. Review of Central Maine Power Company's 1996 DSM targets and presentation of alternative efficiency targets and associated budgets. Evaluation of CMP's DSM proposal in the context of basic program design principles.

26. **Ontario Energy Board HR 23; Ontario Hydro 1996 Rate Proceeding; Green Energy Coalition; June 16, 1995 (joint testimony with R. Carlson).**
Examination of social and economic consequences affiliated with Ontario Hydro's existing and proposed industrial discount rates. Specific analysis of load retention and risk-sharing rates, with reference to the Board's stated concerns regarding transparency, consideration of environmental impacts, and due diligence to prevent free ridership.

27. **Ontario Energy Board E.B.L.O. 251; 1995/96 Trafalgar Facilities Expansion Program of Union Gas Limited; Pollution Probe; May 5, 1995; Supplemental Testimony February 8, 1996 (joint testimony with R. Carlson).**
Evaluation of Union Gas Ltd.'s application for Dawn-Parkway/Trafalgar natural gas pipeline system facilities expansion. Verification of its discounted cash flow analysis. Critique of Union's expected energy cost savings to participants from displacement of alternative fuels, and development of alternative energy cost savings estimates. Verification and validation of its long-term transmission facilities expansion model and its total resource cost savings analysis.

28. Ontario Energy Board E.B.R.O. 486; Union Gas Ltd. 1995 Rate Hearing; Pollution Probe; December 5, 1994 (joint testimony with R. Carlson).
Evaluation of Union Gas Ltd.'s gas avoided cost methodology and avoided cost estimates used in its 1995 DSM Plan. Review of Union's avoided cost analysis. Verification of Union's results. Discussion of the limitations inherent in the utility's avoided cost modeling approach, and provision of an alternative perspective to that approach. Development of recommendations for future avoided cost submissions.

29. New York Public Service Commission Case 94-E-0334; Consolidated Edison Company of New York Rate Proceeding; Enersave, Inc., Natural Resources Defense Council, Pace Energy Project, and New York Energy Efficiency Council; September 23, 1994; Revised Testimony October 11, 1994 (joint testimony with J. Peters).
Assessment of proposed changes to Consolidated Edison's demand-side management programs, focusing on the Commercial & Industrial Lighting Program. Analysis of the impacts on rates, revenue requirements, and societal costs associated with demand- and supply-side resources. Discussion of the interaction between electricity rates and economic competitiveness. Provision of recommendations concerning changes to the utility's proposed DSM program.

30. Maine Public Utilities Commission Docket 92-345, Phase II; Central Maine Power Company's Proposed Increase in Rates; Office of the Maine Public Advocate; June 15, 1994 (joint testimony with R. Carlson).
Discussion of Central Maine Power Company's load-building programs, including fuel-switching, within the context of Maine's economic and regulatory environment. Assessment of short-run and long-run risks associated with Central Maine Power Company's flexible pricing proposal. Review of pricing flexibility impacts from surplus energy auctions. Provision of recommendations concerning appropriate cost-effectiveness tests for load-building activities, limitations to auction of surplus electricity, and the insulation of residential rates from the impact of commercial/industrial sector promotional activities.

31. Ontario Energy Board HR 22; Ontario Hydro 1995 Rate Proceeding; Grand Council Treaty #3; June 2, 1994.
Summary of First Nation concerns relating to the proposed corporate restructuring of Ontario Hydro and potential impacts on price of electricity and quality of service. Discussion of the potential impact of restructuring on the settlement of outstanding grievances.

32. Ontario Energy Board HR 22; Ontario Hydro 1995 Rate Proceeding; Nishnawbe Aski Nation and Grand Council Treaty #3; June 2, 1994 (joint testimony with R. Carlson).
Review of First Nation concerns related to Ontario Hydro's ratesetting policies

and orientations, including proposed discount rates and market-based pricing. Assessment of the potential impacts of rate restructuring on rural rates and equity. Critique of Ontario Hydro's cost allocation process and its potential impacts on rural customers.

33. **Ontario Energy Board HR 22; Ontario Hydro 1995 Rate Proceeding; Green Energy Coalition; June 2, 1994 (joint testimony with R. Carlson).**
Summary of general considerations relating to discounted industrial rates. Outline of the problems inherent in Ontario Hydro's proposed strategy of offering discount rates to industrial customers. Description of the applicable standard for granting special discount rates. Recapitulation of Hydro-Québec's experiences and financial difficulties associated with a strategy promoting discount rates.

34. **Florida Public Service Commission Case Nos. 930548-EG to 930551-EG; Adoption of Numeric Conservation Goals and Consideration of National Energy Policy Act Standards by Florida's Investor-Owned Utilities; Florida Department of Community Affairs; April 29, 1994 (joint testimony with B. Krier).**
Discussion of precedents for utility commission consideration of employment and economic development issues. Summary of the role of energy efficiency programs in Florida's economic development. Interpretation of the qualitative findings contained in a companion Goodman Group report entitled The Employment Impacts of Electricity Efficiency in Florida. Comparison of this analysis with standards and practices utilized in similar studies in other jurisdictions.

35. **Ontario Energy Board E.B.L.O. 246 Amended; 1994/95 Trafalgar Facilities Expansion Program of Union Gas Limited; Pollution Probe; April 4, 1994; Supplemental Oral Direct Testimony April 22, 1994 (joint testimony with R. Carlson).**
Assessment of utility's demand-supply framework. Review of natural gas use projections and potential impacts of DSM and greenhouse gas restrictions. Critique of utility's application of cost-benefit test. Evaluation of fuel-switching analysis. Critique of fuel price forecasts utilized. Analysis of economic risk associated with proposed Dawn-Parkway/Trafalgar natural gas pipeline system facilities expansion.

36. **State of New York Assembly Standing Committee on Energy and Assembly Standing Committee on Environmental Conservation; March 2, 1994.**
Assessment of 800 MW Hydro-Quebec/New York Power Authority seasonal diversity contract in the context of reduced load forecasts, increased projections for independent power production and demand-side management, and the changing wholesale power markets. Analysis of the contract's cost-

effectiveness. Analysis of risk, reliability, and economic development considerations.

37. **Maine Public Utilities Commission Docket No. 93-147; Central Maine Power Company Petition for a Certificate of Public Convenience and Necessity to Erect a Transmission Line Carrying 100 Kilovolts or More in York County; Maine Public Utilities Commission Staff; September 21, 1993 (joint testimony with R. Carlson and W. Scott).**
Assessment of peak load forecasts through 2008 for York County. Economic analysis of the need for a transmission line. Cost-effectiveness analysis of alternative line routes.

38. **Maine Public Utilities Commission Docket No. 92-331; Airco Industrial Gases Request for Interruptible Load Retention Service Rate with Central Maine Power Company; Maine Public Utilities Commission Staff; July 9, 1993; Supplemental Testimony August 10, 1993 (joint testimony with R. Carlson and R. McCullough).**
Assessment of request for a special industrial rate. Review of supply and demand trends in the industrial gases industry. Analysis of production scheduling and transportation cost models. Calculation of internal rates of return based on alternative assumptions. Development of recommendations for the framework, evidentiary standards, and evaluation criteria to be used in consideration of special industrial tariffs.

39. **Ontario Energy Board 169-III; Integrated Resource Planning for Ontario's Local Gas Distribution Companies; Ontario Metis and Aboriginal Association; November 20, 1992.**
Identification of importance of considering environmental and social externalities in energy planning generally and in Ontario natural gas industry specifically. Formulation of recommendations for incorporating externalities into the planning process. Consideration of externalities from the standpoint of the Aboriginal population.

40. **Government of Canada and Government of Manitoba; Conawapa Project Environmental Assessment; Concerned Citizens of Manitoba, Sierra Club of Western Canada (Manitoba Branch), Manitoba Naturalists Society, Inc., Manitoba Branch of the Canadian Parks and Wilderness Society, and Time to Respect Earths' Ecosystems (TREE) Inc.; June 4, 1992 (joint testimony with C. Goodwin and W. Marcus).**
Discussion of the need for environmental reviews to evaluate justification of design alternatives to the proposed 1290 MW Conawapa Project. Description of changes in the utility industry and new supply resource options that will affect the design alternatives included in an environmental review. Review of the treatment of project justification in North American environmental assessments.

41. Government of Canada and Government of Québec; Great Whale River Project Environmental Review; Grand Council of the Crees (of Québec); March 18, 1992 (joint testimony with R. McCullough).
Discussion of the need for environmental reviews to evaluate justification of design alternatives to the 3160 MW Great Whale River Project. Description of changes in the utility industry and new supply resource options that will affect the design alternatives included in an environmental review. Review of the treatment of project justification in North American environmental assessments.

42. New York Public Service Commission Case 90-E-0775; Petition to Reopen Proceeding and Determine the Prudence of the Contracts for Delivery of Hydro-Quebec Power; Environmental Defense Fund, Center for Environmental Legal Studies of the Pace University School of Law, Natural Resources Defense Council, National Audubon Society, Sierra Club, (Atlantic Chapter), Greenpeace U.S.A., Environmental Planning Lobby, and Hudson River Sloop Clearwater; November 25, 1991.
Review of the need for a contract for purchases of Hydro-Québec power by New York utilities. Summary of declining load forecasts and changes in the supply outlook. Analysis of the cost-effectiveness of the proposed purchase. Discussion of risk, reliability, and other considerations.

43. State of Vermont Supreme Court and Public Service Board; In re: Application of Twenty-Four Electric Utilities for a Certificate of Public Good Authorizing Execution and Performance of a Firm Power and Energy Contract with Hydro-Québec and a Hydro-Québec Participation Agreement, and Specifically Concerning Motions for a Remand to the Board for a New Trial; October 15, 1991; Reply Affidavit October 28, 1991.
Review of a contract for purchases of Hydro-Québec power by Vermont utilities. Summary of changes concerning load forecasts and supply-side alternatives. Analysis of how these changes affect the cost-effectiveness of the contract.

44. State of New York Assembly Energy Committee Senate Environmental Conservation Committee; September 30, 1991 (updated October 7, 1991).
Assessment of Hydro-Quebec contract in the context of reduced load forecasts, increased projections for independent power production, and the changing wholesale power markets. Analysis of the contract's cost-effectiveness. Estimation of risk, reliability, and economic development considerations.

45. New York Public Service Commission Case 91-E-0462; Consolidated Edison Company of New York Rate Proceeding; City of New York; September 6, 1991.

Review of Consolidated Edison's demand-side management programs. Analysis of program delivery mechanisms and incentive levels. Identification of additional cost-effective efficiency measures. Discussion of opportunities for increased cooperation between Consolidated Edison and the City of New York to achieve greater efficiency.

46. **New York Public Service Commission Case 91-E-0462; Consolidated Edison Company of New York Rate Proceeding; Environmental Defense Fund, National Audubon Society, Greenpeace, and Center for Environmental Legal Studies; September 6, 1991.**
Analysis of Consolidated Edison's resource planning process with respect to demand-side management programs and the 482 MW Hydro-Québec purchase. Evaluation of demand-side management and the Hydro-Québec purchase in context of long run avoided cost estimates. Determination of cost-effectiveness of Hydro-Québec contract. Discussion of risk, reliability, environmental and economic development considerations relating to the Hydro-Québec purchase.

47. **New York Public Service Commission Case 90-E-1185; Long Island Lighting Company Rate Proceeding; Vladeck, Waldman, Elias and Englehard, Natural Resources Defense Council, and Center for Environmental Legal Studies; June 3, 1991 (joint testimony with C. Komanoff).**
Evaluation of Long Island Lighting Company's proposed 20 year, 218 MW purchase of electricity from Hydro-Québec. Comparison of Long-Run Avoided Cost and the Hydro-Québec purchase. Review of supply and demand options as alternatives to the purchase. evaluation of risk, reliability, environmental, and economic development considerations.

48. **Québec Access to Information Commission No. 90-04-07; Risk-Sharing Contracts; Grand Council of the Crees (of Québec); May 3, 1991.**
Analysis of confidential risk-sharing electricity supply contracts between Hydro-Québec and thirteen large industrial customers. Description of participants by company ownership, location, principal activities, and business relationships. Estimation of energy and capacity required to service contracts. Assessment of resulting implications for Hydro-Québec and its ratepayers. Review of treatment of electricity contracts for aluminum smelters and other large industrial customers in North American jurisdictions.

49. **Massachusetts Department of Public Utilities 90-261-A; Massachusetts Electric Fuel Switching; Massachusetts Division of Energy Resources; April 17, 1991.**
Evaluation of fuel switching as a demand-side management option. Review of current status of fuel-switching technologies. Formulation of cost and benefit allocation algorithms to optimize program participation and maximize societal

benefits by incorporating fuel choice options, including renewables and active and passive solar, as part of utility least-cost planning.

50. **State of Vermont, Chittenden County Superior Court, Docket S518-91 CnC; March 5, 1991 Burlington Municipal Election Question 8; Grand Council of the Crees (of Québec); March 28, 1991.**
Analysis of Burlington Electric Department Assessment provided as "voter information" in referendum concerning power purchase contract with Hydro-Québec. Evaluation of accuracy and impartiality of information concerning cost estimates, alternative sources of supply, environmental effects, and economic benefits.

51. **Manitoba Public Utilities Board; Manitoba Hydro Submission in Respect to Major Capital Projects; Concerned Citizens of Manitoba, Sierra Club of Western Canada (Manitoba Branch), and Conservation Strategy Association of Manitoba; July 23, 1990; Surrebuttal Testimony August 30, 1990 (joint testimony with W. Marcus).**
Review of Manitoba Hydro's submission and the proposed: construction of 1290 MW Conawapa generating station and other northern hydro projects; 100 MW demand-side management program; twenty-two year, 1000 MW power sale to Ontario Hydro; and two 150 MW seasonal diversity exchanges. Review of Manitoba Hydro load forecasting. Estimation of economic and attainable conservation potential. Development of principles of conservation program design and delivery. Critique of utility's proposed demand-side management program. Evaluation of alternative supply-side resources. Analysis of avoided costs. Assessment of employment and economic development effects of hydroelectric development and conservation. Analysis of profitability and risks of proposed power sales contracts.

52. **State of New York Supreme Court; Application of Sierra Club, Inc. et al. For Judgment Under Article 78 Against the Power Authority of the State of New York, et al.; April 18, 1990; Reply Affidavit August 6, 1990; Supplemental Reply Affidavit September 13, 1990.**
Analysis of nexus between New York Power Authority purchases and construction of specific Québec hydro facilities and operation of fossil fuel electric generation. Evaluation of power imports in New York State Energy Plan. Assessment of energy conservation as a potential substitute for hydro and fossil generation. Comparison of employment and economic development impacts of power purchase and conservation options.

53. **Canadian National Energy Board Hearing Orders No. EH-3-89 and AO-1-EH-3-89; Application of Hydro-Québec for Export License for Firm Power and Energy Contracts with Vermont Joint Owners and New York Power Authority; Grand Council of the Crees (of Québec); February 14, 1990 (joint testimony with W. Marcus).**
Review of a proposed thirty year, 450 MW sale of Hydro-Québec power to

twenty-four Vermont utilities and review of a proposed twenty year, 1000 MW sale of Hydro-Québec power to the New York Power Authority. Analysis of planning and operation of Hydro-Québec power supply. Modeling of hydro reservoir levels. Determination of marginal supply resources associated with sales to Vermont and New York. Estimation of acid rain and greenhouse gases emissions from fossil and hydro generation. Analysis of reliability including adequacy of energy, capacity, and transmission supply. Estimation of achievable conservation potential in Québec. Analysis of the profitability of the proposed power sales on both a private cost and social cost basis.

54. **Vermont Public Service Board Docket 5330; Application of Vermont Utilities for Approval of a Firm Power and Energy Contract with Hydro-Québec; Grand Council of the Crees (of Québec) and New England Coalition for Energy Efficiency and the Environment; December 19, 1989; Supplemental Testimony January 18, 1990 (joint testimony with W. Marcus). Docket 5330-A; Testimony April 30, 1991.**
Review of a proposed thirty year, 450 MW purchase of Hydro-Québec power by twenty-four Vermont utilities. Analysis of planning and operation of Hydro-Québec power supply. Modeling of hydro reservoir levels. Determination of marginal supply resources associated with sales to Vermont. Estimation of acid rain and greenhouse gases emissions from fossil and hydro generation. Analysis of risk and reliability including supply diversity, and adequacy and security of energy and transmission supply. Estimation of achievable conservation potential in Québec. Development of proposal for exports to Vermont based on conservation and alternative supply resources in Québec. Evaluation of costs and benefits of Vermont Joint Owners' proposed Waiver and Release to extend the date for cancellation of export contracts without penalty.

55. **Massachusetts Department of Public Utilities 89-72; Statewide Towing Association, Police-Ordered Towing Rates; Massachusetts Automobile Rating and Accident Prevention Bureau; September 13, 1989 (joint testimony with P. Chernick).**
Review of study supporting proposed increase in towing rates. Critique of study sample and methodology. Comparison with competitive rates. Supply of towing services. Effects of joint products and joint sales on profitability of police-ordered towing.

the goodman group, ltd.

November 14, 2018

Thomas J. Young
Office of the Attorney General
2425 Bristol Court SW
P.O. Box 40117
Olympia WA 98504-0117

Re: Research and Analysis on Millennium Bulk Terminals-Longview Proposed Coal Export Terminal

Dear Tom,

This letter is to confirm total compensation being provided for preparation of an Expert Report on Millennium Bulk Terminals-Longview/Lighthouse to be submitted November 14, 2018, in the matter of:

Lighthouse Resources, Inc., et al. v. Jay Inslee, et al.
Court/Cause No.: U.S.D.C. (West) No. 3:18-cv-05005-RJB.

Total compensation is $150,000 for 750 hours of consulting (Direct Labor), consisting of Ian Goodman (520 hours @ $200/hour = $104,000) and Brigid Rowan (230 hours @ $200/hour = $46,000).

Sincerely,

Ian Goodman

Ian Goodman
President

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