Chapter 2
Purpose and Need

This chapter presents the project purpose and need for the proposed Millennium Bulk Terminals—Longview export terminal. The National Environmental Policy Act (NEPA) requires an environmental impact statement (EIS) include the underlying purpose and need for the proposed action to explain why the project proponent, or Millennium Bulk Terminals—Longview, LLC (Applicant) is undertaking the proposed action and what objectives they intend to achieve. The purpose and need statement is also used to determine the appropriate range of alternatives to be evaluated in the EIS.

2.1 Project Purpose

The purpose of the proposed action is to construct and operate a terminal for the transfer of western U.S. coal from rail to ocean-going vessels for export to Asia. As discussed in more detail in Section 2.2, *Project Need*, the Applicant has determined there is sufficient Asian market demand for western U.S. low-sulfur subbituminous coal to warrant development of a terminal in the western United States to export coal. Additionally, the Applicant has determined existing west coast terminals are unavailable to serve this need. Therefore, the Applicant is proposing to build an export terminal sufficient in throughput to take advantage of economies of scale and allow for efficient rail-to-ship transfer of coal for shipment to Asian markets.

2.2 Project Need

The need for the proposed action is to meet Asian demand for low-sulfur subbituminous coal available in the western United States.[1] This need is supported by the following observations made by the Applicant.

- Asia's demand for coal has increased significantly in recent years.

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[1] **Types of Coal.** Coal is commonly divided into four "ranks" based primarily on heat content.

- **Lignite:** Lignite (often called brown coal) is brownish-black with a high moisture content. It has the lowest heat value. Lignite ranges from partially decayed peat to a final gel-like material. Lignite mines in the United States are located primarily in Montana, North Dakota, Louisiana, and Texas.
- **Subbituminous coal:** Subbituminous coal forms from the lignite gel that has been heated to at least 150 degrees Fahrenheit (^{0}F). It is harder, blacker, and has a higher heat content than lignite. Wyoming's coal is subbituminous. Major reserves of subbituminous coal are also found in Montana, Colorado, New Mexico, Washington, and Alaska.
- **Bituminous coal:** Higher, longer lasting temperatures acting on subbituminous coal result in the formation of bituminous coal. Bituminous coal (often called hard coal) has a higher heat content than lignite or subbituminous. In the United States, bituminous coal is mined primarily in Appalachia and in the mid-western states of Iowa, Illinois, Indiana and Ohio.
- **Anthracite coal:** Anthracite (also called hard coal) was formed when bituminous coal underwent even more heat over a longer time and is usually associated with mountain building forces. Though rare, anthracite has the highest heat content. Pennsylvania's anthracite coal seams are the largest in the world.

Source: Wyoming Mining Association 2016.

- The heat value of subbituminous coal produced in the Powder River Basin is desired by certain Asian countries, such as Japan, South Korea, and Taiwan.
- The cost to export Powder River Basin coal from the Pacific Northwest region of the United States to Asia is competitive with coal exports from countries such as Australia and Indonesia.

These observations are explained further in the following sections.

2.2.1 Increased Asian Demand for Coal

The Applicant has determined there is sufficient Asian market demand for western U.S. low-sulfur subbituminous coal to warrant the development of an export terminal on the west coast of the United States. According to the U.S. Energy Information Administration (EIA), global coal demand has almost doubled since 1980, driven by increases in Asia, where demand grew approximately 400% between 1980 and 2010[2] (Figure 2-1). China, Japan, South Korea, and Taiwan have historically been the world's primary importers of coal (U.S. Energy Information Administration 2011) and have government-mandated, long-term energy plans detailing energy production choices. Countries like Japan have predetermined a certain percentage of their electrical generation will come from coal, regardless of the price. Unlike the United States, they regulate and plan for those fuel sources based on their national security and economic needs, not based on market pricing. Each country's demand for coal is described in the following sections. The Applicant reports its primary markets to be Japan, South Korea, and Taiwan.

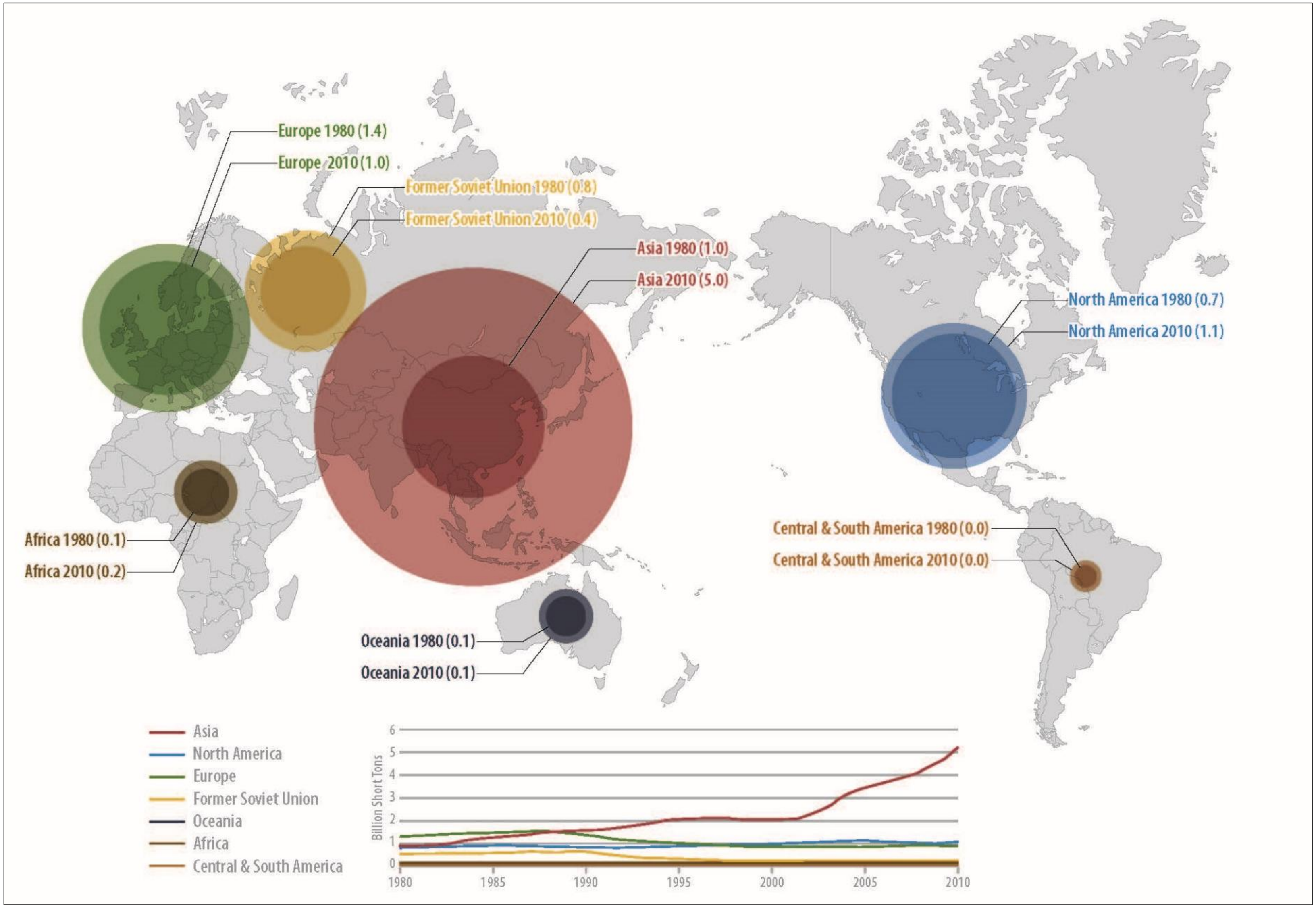
2.2.1.1 China

Asian coal demand is dominated by China, the world's largest coal producer and consumer. China's coal demand—driven by power generation and industrial uses—increased by an average of 8.44% annually from 2001 to 2012. For comparison, coal demand outside of China increased at an average of 3.8% per year (U.S. Energy Information Administration 2013a). However, coal consumption in China and across the globe actually slipped in 2012 by about 1.7% and 1.2%, respectively. As of 2012, China's coal consumption accounted for 47% of global coal consumption at about 3.9 billion tons annually—almost as much as the entire rest of the world combined (U.S. Energy Information Administration 2013b).

China's demand for coal is expected to grow. Although current policy changes in China will reduce the growth rate of coal consumption, the absolute amount of coal consumed will continue to increase. Projection by the U.S. Environmental Protection Agency (EPA) of China's power generation shows coal will produce 67% to 75% of the nation's electrical energy from 2012 to 2040. Coal-fired electric power generation is expected to increase by 87% compared to current 2013 levels (U.S. Energy Information Administration 2013b).

[2] "[C]oal remains the second-largest energy source worldwide—behind petroleum and other liquids—until 2030. From 2030 through 2040, it is the third-largest energy source, behind both liquid fuels and natural gas. World coal consumption increases from 2012 to 2040 at an average rate of 0.6%/year, from 153 quadrillion Btu in 2012 to 169 quadrillion Btu in 2020 and to 180 quadrillion Btu in 2040." (International Energy Outlook 2016)

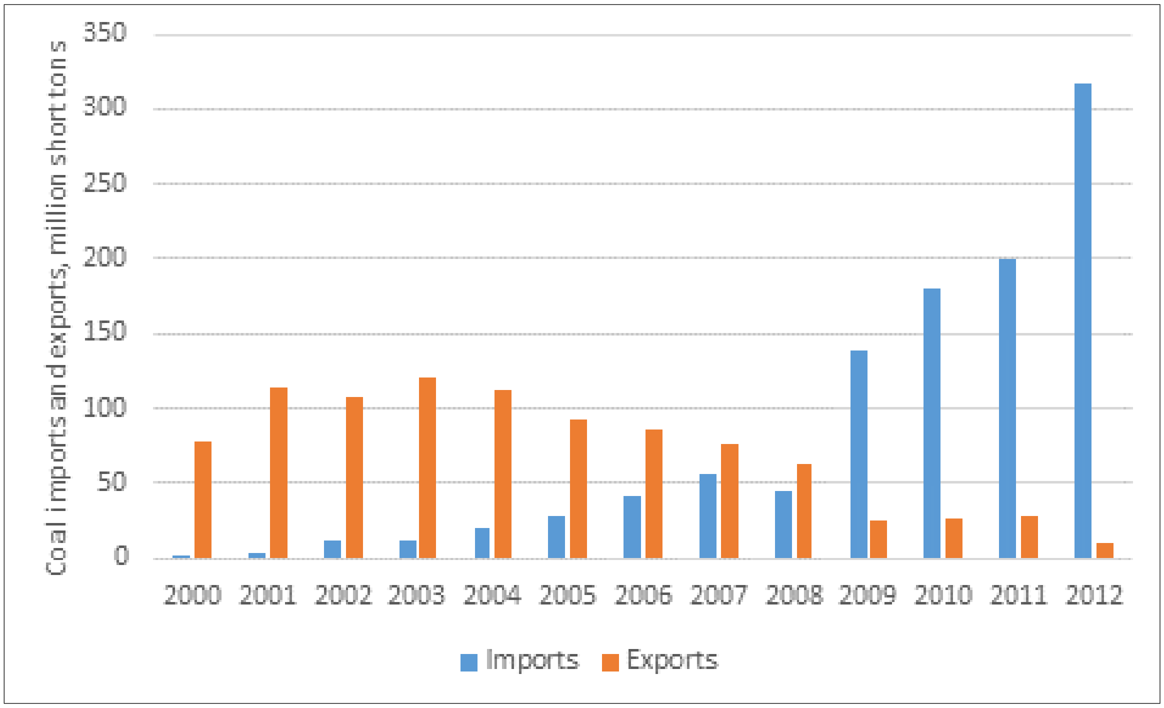
Figure 2-1. World Coal Consumption by Region from 1980–2010 (billion short tons)



Source: U.S. Energy Information Administration 2011

With its vast domestic coal resources, China has historically been a coal exporter, however, its coal imports exceeded exports for the first time in 2009 (Figure 2-2). In 2012, China imported 318 million tons of coal, or approximately 8% of total Chinese coal consumption (U.S. Energy Information Administration 2013c).[3] The increase in imports has been rapid and dramatic, and suggests a strong market in the Pacific Basin.

Figure 2-2. China's Coal Imports and Exports, 2000–2012 (million tons)



Source: U.S. Energy Information Administration 2012a.

While analysts expected China's reliance on imports to increase through 2015, Chinese coal imports have actually fallen since peaking in 2013. Weaker economic growth has led to lower coal consumption, while a governmental emphasis on reducing the energy intensity of their economy and lowering air pollution are both compounding factors as well. In response, the government has protected domestic industry and prioritized domestic coal consumption. These measures resulted in a Chinese import tariff of 6% for thermal coal as of October 2014 (The Guardian 2015; Sustainable Enterprise Media 2015).

2.2.1.2 Japan

Without domestic coal resources, Japan relies heavily on imports to satisfy its coal demands. Japan was the world's largest coal importer through 2010; however, after 2010, China became the world's largest coal importer. In 2012, Japan imported about 204 million short tons of coal (U.S. Energy Information Administration 2013c).

[3] For reference, 318 million tons is about 72% of recent annual coal production from the Powder River Basin.

2.2.1.3 South Korea

South Korea is one of the top energy importers in the world, relying on fuel imports for about 97% of its energy demand due to lack of domestic fuel resources. In 2012, South Korea imported about 136 million short tons of coal and was the world's third largest importer of coal behind China and Japan (U.S. Energy Information Administration 2013c). Australia and Indonesia account for the majority of South Korea's coal imports, followed by Russia. Between 2005 and 2012, coal consumption in South Korea increased by 55%. This rise was driven primarily by a growing demand from the electric power sector. The electric power sector accounts for 62% of the country's coal consumption, while the industrial sector accounts for most of the remaining amount (U.S Energy Information Administration 2015a).

2.2.1.4 Taiwan

Oil and coal made up 41% and 34% of Taiwan's total primary energy consumption in 2013, respectively, while the remainder was mostly natural gas, nuclear, and smaller amounts of various renewable energy sources (U.S. Energy Information Administration 2014a). Due to its very limited domestic energy resources, Taiwan imports a large percentage of coal and oil. Taiwan consumed about 72 million tons of coal in 2012, all of which was imported (U.S. Energy Information Administration 2013c). Coal consumption steadily increased since the 1990s and slowed after 2007, as a result of natural gas and renewables substituting some coal supply in the power sector.

2.2.2 Coal Quality and Heat Value Desired by Asian Countries

The fast-growing economies in Asian countries, such as Japan, South Korea, and Taiwan, have spurred rapid growth in energy demand. This demand has resulted in the construction of new energy sources across all energy sectors, including the construction of new coal-fired power plants.[4] The existing power plants in these countries were generally designed to burn low-sulfur bituminous coal supplied from Australia and South Africa. More recently, however, the supply of low-sulfur subbituminous coal from Indonesia has grown rapidly to become the largest source coal for Asian power plants, at a lower cost per unit of energy produced than bituminous coal. New Asian power plants have been designed to use either subbituminous or bituminous coal and some existing plants are blending coal types to reduce costs.

Coal in the United States is mainly found in three regions: the Appalachia coal region (with West Virginia being the largest producer), the Interior coal region (with Illinois being the largest producer), and the Western coal region, of which Wyoming is the largest producing state in the nation. More than half of the coal production in the United States is produced in the Western coal region, which includes the Powder River Basin (southeastern Montana and northeastern Wyoming) and the Uinta Basin (western Colorado and eastern Utah) (U.S. Energy Information Administration 2014b).

Coal is categorized by rank, with three ranks used in the United States. The coal ranks are (from hardest and highest heat content to softest and lowest heat content) bituminous, subbituminous,

[4] The BP Energy Outlook forecasts a 54% increase in Asia Pacific's energy consumption through 2035. Coal demand is expected to rise by 27% as it is expected to remain the dominant fuel produced in the region with a 56% market share in 2035. (BP Energy Outlook 2016)

and lignite. Bituminous coal is mined in the Appalachian and Illinois Basins as well as in the Rocky Mountains.[5] Subbituminous coal is primarily mined in the Powder River Basin. Lignite coal is primarily found in Texas and the Great Plains area of North Dakota and Montana.

Within each rank, coal is graded by the heat content as well as the impurities found in the coal, such as sulfur, mercury, chlorine, and ash. High quality coal has a higher heat content and lower concentrations of impurities. Generally, higher heat content coal sells at a higher price, and coal with lower concentrations of trace elements sells for a higher price, all else being equal. Table 2-1 shows the energy and sulfur content of coal from three major U.S. coal regions.

Table 2-1. Typical Energy and Sulfur Dioxide Content of Coal from Major U.S. Coal Regions

Region	Btu/Pound	Pounds Sulfur Dioxide per million Btu[a]
Appalachia Coal Region		
Central Appalachia	12,500	1.2
Northern Appalachia	13,000	<3.0
Interior Coal Region		
Illinois Basin	11,800	5.0
Western Coal Region		
Powder River Basin	8,800	0.8
Uinta Basin	11,700	0.8

Notes:
Source: U.S. Energy Information Administration 2015b
[a] Ratio of percent sulfur to heat content
Btu = British thermal unit; SO_2 = sulfur dioxide

As shown in Table 2-1, western U.S. coal low in sulfur comes from the Powder River Basin and the Uinta Basin. The sulfur dioxide content[6] for Powder River Basin coal is less than 1 pound per million Btu, which is substantially lower than coal mined from most other U.S. coal regions, which have sulfur dioxide contents greater than 1 pound.

When compared to international coal sources (Table 2-2), the sulfur content of Powder River Basin coal is approximately half the sulfur content of coal from Indonesia, which is the primary competitor for the subbitumous coal that would be shipped from the proposed export terminal. Powder River Basin coal also is a subbituminous coal with a lower ash content than Indonesian coal (Table 2-2). There is a wide range of coal quality produced and exported from Indonesia, with subbituminous grade coal comprising the majority of its exports. Powder River Basin coal, which would be exported through the proposed export terminal, is most comparable to Indonesian subbituminous coal. The coal exported from the proposed export terminal would directly compete with lower heat content coal, which has a lower delivered cost per BTU than bituminous coal. The typical specifications of coal traded in the Asian market are shown on Table 2-2.

[5] The Uinta Basin is part of the Rocky Mountain coal production area.

[6] Sulfur dioxide content is a measure of the amount of sulfur dioxide emitted from combustion of sulfur in coal per million Btu of heat content, before removal by emission controls.

Table 2-2. Typical Quality Specifications for Energy (Btu) and Sulfur Content of Coal from Indonesia, Australia, and the Powder River Basin

Coal Source	Coal Type	Btu/Pound	Percent (%) Sulfur	Percent (%) Ash Content	Percent (%) Total Moisture
Indonesia[a]	Bituminous	10,620[b]	0.80	8	15
Indonesia[a]	Subbituminous	9,000[b]	0.80	8	26
Indonesia[a]	Subbituminous	7,560[b]	0.60	7	35
Australia[a]	Bituminous	11,340[b]	0.6	8	10
Powder River Basin[c] (WY)	Subbituminous	8,800	0.35	5	27
Powder River Basin[d] (MT)	Subbituminous	9,350	0.35	5	27

Notes:
[a] Source: Platts Coal Methodology and Specifications Guide, April 2016.
[b] Converted from kcal/kg: (kcal/kg * 1.800) = Btu/lb.
[c] Source: U.S. Energy Information Administration 2015b, Black Thunder Mine (Arch Coal 2013).
[d] Source: Cloud Peak Energy, Spring Creek Mine (Cloud Peak 2009).
Btu = British thermal units; WY = Wyoming; MT = Montana

To capture differences in the heat and sulfur content of coal, a two-letter "coal grade" nomenclature is used for this Draft EIS. The first letter indicates the coal rank (bituminous, subbituminous, or lignite) with their associated heat content ranges, as shown in Table 2-3. The second letter indicates their sulfur grade, i.e., the sulfur dioxide ranges associated with a given type of coal. The sulfur grades and associated sulfur dioxide ranges are shown in Table 2-4.

Table 2-3. Coal Rank Heat Content Ranges

Coal Type	Heat Content (Btu/lb)	Classification
Bituminous	>10,260–13,000	B
Subbituminous	>7,500–10,260	S
Lignite	Less than 7,500	L

Notes:
Btu/lb = British thermal units per pound

Table 2-4. Coal Grade Sulfur Dioxide Content Ranges

SO_2 Grade	SO_2 Content Range (lbs/MMBtu)
A	0.00–0.80
B	0.81–1.20
D	1.21–1.66
E	1.67–3.34
G	3.35–5.00
H	> 5.00

Notes:
SO_2 = sulfur dioxide; lbs/MMBtu = pounds per million metric British thermal unit

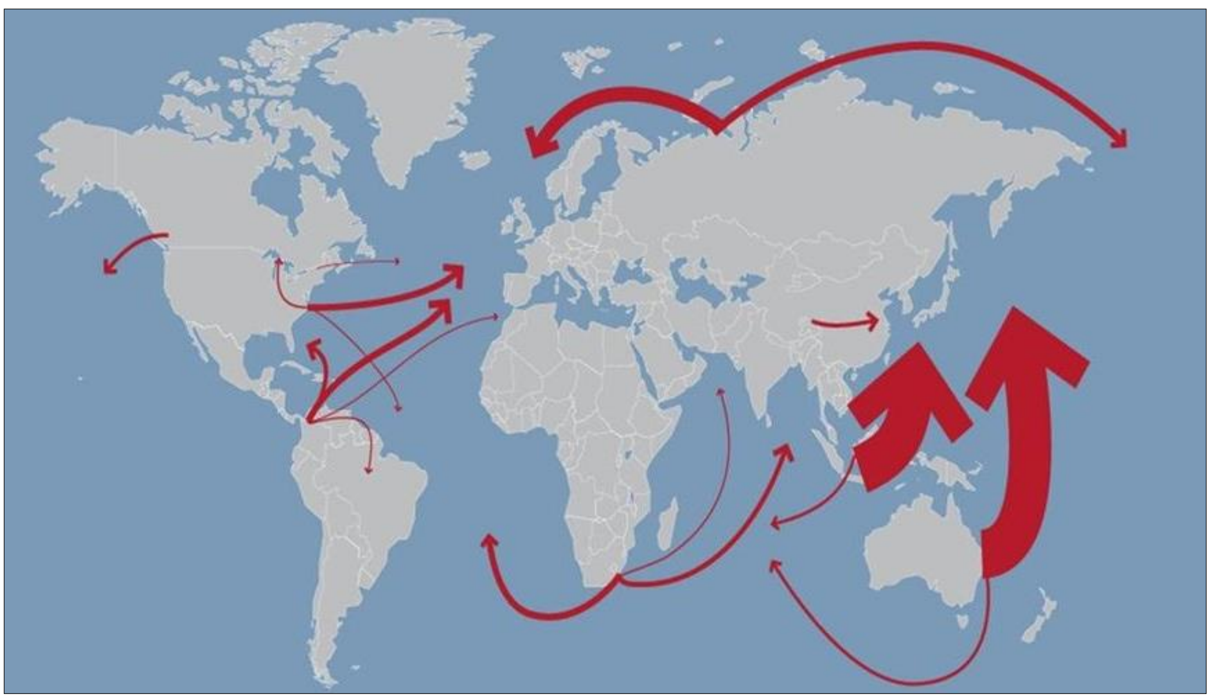
Powder River Basin coal is graded "SA" because this region produces a subbituminous coal with a moderate heat content (Tables 2-1 and 2-3) and the coal has a very low sulfur dioxide content (Tables 2-1 and 2-4).

2.2.3 Cost Competitiveness to Ship Coal from the Western United States to Asian Markets

For the proposed export terminal to be economically viable, the cost of coal must be competitive in Asian energy markets with coal from other international supply regions. The primary competitors for coal shipped from the proposed export terminal are expected to be Australia and Indonesia. Australia exports high volumes of bituminous coal of a comparable heat value to Uinta Basin bituminous coal. Indonesia exports high volumes of subbituminous coal with comparable heat value to Powder River Basin subbituminous coal.

Australia was the world's largest coal exporter for 25 years (U.S. Energy Information Administration 2014c). However, in 2011, Indonesia surpassed Australia in terms of coal exports on a weight basis and is now the world's largest exporter of coal by weight, with Australia being the world's second-largest coal exporter (U.S. Energy Information Administration 2014d) (Figure 2-3). In 2012, Indonesia exported 383 million short tons of coal (U.S. Energy Information Administration 2014c), and Australia exported 332 million short tons of coal (U.S. Energy Information Administration 2014d). Indonesia has abundant coal reserves and is geographically proximate to coal-importing countries in Asia (U.S. Energy Information Administration 2014d).

Figure 2-3. Coal Exporters and Their Markets



Source: Alpha Natural Resources 2010.

To compete with Australian and Indonesian exporters, the proposed export terminal would need to be competitive in coal quality, throughput capacity, and transportation rates.

2.2.3.1 Coal Heat Value and Quality

Coal from the Powder River Basin has both similarities and differences with Australian and Indonesian coal. These distinctions can be important factors for foreign consumers in selecting one coal over another. As discussed above, Powder River Basin coal has a sulfur content of less than 1%, which is desired by Asian power companies, and a sulfur content lower than Australian and Indonesian coal (Table 2-2). Australia exports primarily bituminous[7] coal from the states of Queensland and New South Wales to Japan, China, South Korea, India, and Taiwan (U.S. Energy Information Administration 2014c). The Powder River Basin, on the other hand, produces subbituminous coal, which is similar in heat value to the subbituminous coal exported from Indonesia. Additionally, buyers in South Korea and Japan prefer low-ash coal for power generation, a characteristic shared by Indonesian and Powder River Basin subbituminous coal (Table 2-2).

2.2.3.2 Throughput Capacity

Because Australia and Indonesia are the world's largest coal exporters to the Pacific Basin, reviewing the throughput capacities for Australian and Indonesian coal export terminals was essential for determining a viable throughput capacity for the proposed export terminal. Note, however, the throughput of an Indonesian terminal is determined largely by the production of the upstream mines, the number of barges used, and the number of berths available, not the capacity of fixed shiploaders or stockpiles as with Australian and American coal terminals. For this reason, the throughput capacity and design of Indonesian terminals are not comparable to Australian or American terminals. Australian coal terminals provide more information on the appropriate throughput for a competitive Pacific Northwest coal terminal than their Indonesian competitors because Australian and American terminals are similar in design and operation.

Although Indonesian terminals are not comparable to Australian or American terminals, Indonesian terminals are discussed here because Indonesia has abundant coal reserves, is geographically proximate to coal-importing countries in Asia, and is currently the world's largest exporter of coal by weight (U.S. Energy Information Administration 2014d).

The throughput capacity of coal export terminals from both countries are described in the following sections.

Australian Coal Export Terminals

Table 2-5 illustrates the throughput and berthing capabilities of existing and proposed Australian coal export terminals. The size of these Australian terminals is illustrative of the project size required by the proposed export terminal because these terminals are rail-served, land-based terminals that transfer coal from rail to ships for overseas export.[8] All existing and planned Australian terminals are designed to load Capesize vessels[9] (Table 2-5).

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[7] Bituminous coal is a soft coal containing a tarlike substance called bitumen. It accounts for approximately 50% of the coal produced in the United States and has a carbon content of between 77% and 87%, and a heating value much higher than lignite or subbituminous coal.

[8] Since Australia supplies bituminous coal, it is not expected to materially compete with the proposed export terminal, which would primarily supply subbituminous coal.

[9] Capesize vessels are very large cargo vessels with a capacity over 100,000 dead weight tonnage (DWT) and can be as large as 400,000 DWT or even more, although they often have a capacity between 130,000 and 150,000 DWT. Capesize vessels serve regions with the largest deepwater terminals in the world and are primarily used for transporting coal and iron ore.

Table 2-5. Throughput Capacity of Australian Coal Export Terminals[a]

<table>
<tr><th>Terminal</th><th>Year Opened</th><th colspan="2">Current Throughput Capacity (MMTPY)</th><th>Number of Berths and Vessel Capacity</th></tr>
<tr><td colspan="5">Port of Newcastle, New South Wales</td></tr>
<tr><td>Newcastle Coal Infrastructure Group, Coal Terminal</td><td>2010</td><td colspan="2">66</td><td>3 berths
Capesize</td></tr>
<tr><td>Port Waratah Coal Services, Terminal 4 Coal Terminal[b]</td><td>Proposed</td><td>120</td><td rowspan="3">265</td><td>Up to 5 berths
Capesize
(150,000 DWT)</td></tr>
<tr><td>Port Waratah Coal Services, Kooragang Coal Terminal[b]</td><td>1984</td><td>120</td><td>5 berths
Capesize
(210,000 DWT)</td></tr>
<tr><td>Port Waratah Coal Services, Carrington Coal Terminal[b]</td><td>1976</td><td>25</td><td>2 berths
Capesize
(180,000 DWT)</td></tr>
<tr><td colspan="5">Port of Gladstone, Queensland</td></tr>
<tr><td>Wiggins Island Coal Terminal</td><td>Proposed</td><td colspan="2">80</td><td>1 berth
Capesize
(220,000 DWT)</td></tr>
<tr><td>R.G. Tanna Coal Terminal</td><td>1980</td><td colspan="2">>70</td><td>4 berths
Capesize
(220,000 DWT)</td></tr>
<tr><td colspan="5">Port of Abbot Point</td></tr>
<tr><td>Abbot Point Coal Terminal</td><td>1984</td><td colspan="2">50</td><td>2 berths
Capesize
(200,000 DWT)</td></tr>
<tr><td colspan="5">Port of Brisbane</td></tr>
<tr><td>Queensland Bulk Handling Coal Terminal[c]</td><td>1983</td><td colspan="2">10</td><td>1 berth
Capesize
(140,000 DWT)</td></tr>
<tr><td colspan="5">Port of Hay Point</td></tr>
<tr><td>Dalyrmple Bay Coal Terminal</td><td>1983</td><td colspan="2">85</td><td>4 berths
Capesize
(220,000 DWT)</td></tr>
<tr><td>Hay Point Coal Terminal</td><td>1971</td><td colspan="2">44</td><td>2 berths
Capesize
(180,000 DWT and 230,000 DWT)</td></tr>
</table>

Notes:

[a] Terminal information is publicly available on the websites maintained by each port.

[b] The Carrington terminal (25 MMTPY) and Kooragang terminal (120 MMTPY) are jointly owned and geographically proximate and effectively operate as a single 145 MMTPY terminal. When completed, the proposed export terminal (120 MMTPY) would operate in conjunction with the Carrington and Kooragang terminals as one 265 MMTPY terminal.

[c] The Queensland Bulk Handling Terminal operates differently from the other Australian coal terminals, and instead operates similarly to the Indonesian coal terminals. Although this terminal is small by current standards (10 MMTPY), the capacity of this terminal reflects the much smaller production yield of its source mines, which are located in a low coal-production coal mining area (West Moreton and Darling Downs coal fields). As a result, a large terminal similar to the terminals at the Port of Newcastle could not be supported at this location. Additionally, the Queensland Bulk Handling Terminal is not located on a rail line, and instead receives coal by barge, which is then loaded onto ocean-going vessels.

MMTPY = million metric tons per year; DWT = dead weight tonnage

Similar to the proposed export terminal, Australian coal terminals transfer coal from rail to ships and use large stockpiles of coal to maintain throughput. Existing Australian terminals operate with throughputs ranging from 10 to 120 million metric tons per year (MMTPY) of coal. As shown in Table 2-5, most existing Australian terminals have a throughput capacity greater than 44 MMTPY, which is the throughput capacity anticipated for the proposed export terminal.

Indonesian Coal Export Terminals

Indonesian coal export terminals providing similar heat value subbituminous coal would compete with the proposed export terminal. These terminals differ in design and operation from the Australian coal terminals described in Table 2-5. Typically, Indonesian terminals are not located on rail lines (with the exception of the Tarahan Coal Terminal) and they vary greatly in throughput. The terminals presented in Table 2-6 represent the larger land-based coal terminals and larger floating transfer stations serving ocean-going vessels.

However, the majority of Indonesian coal terminals do not resemble Australian or American terminals, which transfer coal from rail to ships and are dependent on the use of large stockpiles to maintain consistent and efficient throughput.[10] Rather than transferring coal from rail to ocean-going vessels, Indonesian coal primarily moves from mines to shipping points through a combination of barging and trucking. The location of an Indonesian coal terminal is determined by its geographic proximity to the corresponding coal sources (mines) and navigable rivers, rather than rail lines.

Inland coal is barged down rivers to land-based terminals or is alternatively trans-loaded directly from barges to ocean-going vessels at floating trans-loading terminals (Ewart and Vaughn 2009). As of 2010, Indonesia had 47 floating trans-loading facilities with a total capacity of 400 MMTPY and 11 land-based terminals with a total capacity of 150 MMTPY (Lucarelli 2011). Because Indonesian coal terminals are not reliant on rail and do not require large land acreage for stockpiles and on-site rail, their configuration and throughput are not relevant to the design of an efficient Pacific-Northwest export terminal.

[10] As demonstrated by the information presented in Table 2-6, Indonesian berths are sized to support Panamax and Capesize vessels, similar to their Australian and American counterparts.

Table 2-6. Throughput Capacity of Indonesian Coal Export Terminals[a]

Terminal	Year Opened	Current Throughput Capacity (MMTPY)	Number of Berths and Vessel Capacity
PT Bayan Resources, Kalimantan Floating Transfer Station[b,c]	2008	35[f]	1 berth Capesize (200,000 DWT)
PT Adaro, Indonesia Bulk Terminal, South Pulau Laut Coal Terminal[b]	1998	12	1 berth Panamax[i] (80,000 DWT)
PT Bayan Resources, Balikpapan Coal Terminal[b]	1995	15	1 berth Panamax (90,000 DWT[j])
PT Arutmin, North Pulau Laut Coal Terminal[b]	1994	14	1 berth Capesize[g]
PT Kaltim Prima, Tanjung Bara Floating Transfer Station[b,c]	—[e]	8	1 berth Capesize
PT Kaltim Prima, Tanjung Bara Coal Terminal[b]	—[e]	40[g]	1 berth Capesize (200,000 DWT)
PT Harum Energy, Muara Jawa/Maura Berau Floating Transfer Station, Samarinda Anchorage[b,c]	—[e]	4	—
PT Bukit Asam, Tarahan Coal Terminal (Sumatra)[d]	—[e]	12[h]	1 berth Panamax (85,000 DWT)
BT Bahar Cakrawala, Sebuku Floating Transfer Station[b,c]	—[e]	4	—
PT Banpu, Bontang Coal Terminal[b]	—[e]	20	1 berth Panamax (95,000 DWT)
PT Kideco, Adang Bay Floating Transfer Station[b,c]	—[e]	37	1 berth Capesize (150,000 DWT)

Notes:

[a] This table presents only a small sample of the floating coal export terminals based in Indonesia. Terminal information is publicly available on the websites maintained by each port/coal company.

[b] Coal is delivered from mine to terminal stockpile by truck, barge, and/or conveyor.

[c] Coal transferred from stockpile to offshore transloading station by barge.

[d] Coal is delivered from mine to terminal via rail. The Indonesian rail system differs from the Australian and U.S. rail systems by serving a limited geographic area, using narrow-gage rail, and having relatively low weight limits (Organisation for Economic Co-operation and Development 2012) that support smaller trains. Therefore, the volume of coal that can be delivered efficiently by rail to an Indonesian coal terminal is much less than an American or Australian coal terminal. American and Australian terminals are designed to receive, stockpile and load large volumes of coal that can be delivered by the geographically interconnected and heavy load bearing rail systems available. For these reasons, a rail-served Indonesian terminal does not provide meaningful information on the appropriate throughput for a competitive Pacific Northwest coal terminal.

[e] Information could not be confirmed.

[f] Based on a loading rate of 4,000 million tons per hour.

[g] PT Bumi Resources 2011.

[h] Planned improvements anticipate upgraded throughput capacity to 25 MMTPY and accommodations for Capesize vessels.

[i] Panamax vessels have an average capacity of 65,000 DWT, and are primarily used for transporting coal, crude oil, and petroleum products.

[j] Can partially load Capesize vessels up to 200,000 DWT.

MMTPY = million metric tons per year; DWT = dead weight tonnage

Proposed Export Terminal

To successfully compete with its Australian and Indonesian competitors, the export terminal proposed by the Applicant must capitalize on economies of scale to overcome the much greater shipping distance it has to reach specific Asian markets (e.g., South Korea). To support this throughput capacity, the Applicant has determined the proposed terminal must be capable of supporting vessels in the Panamax class (or larger) and operate at least two shiploaders.

Vessel Selection

Bulk carriers, such as Handymax, Panamax, and Capesize vessels, are commonly used for transporting coal internationally (World Coal Institute 2005) (Table 2-7). Most seaborne coal delivered to Asian markets is transported in Capesize or Panamax vessels to take advantage of economies of scale relative to smaller vessels. Capesize vessels are larger than 100,000 deadweight tonnage[11] (DWT), often have a capacity between 130,000 and 150,000 DWT, and require a channel with a depth of 55 feet below water surface (bws). Panamax vessels range from 60,000 to 100,000 DWT and require a channel with a depth of at least 42 feet bws (Clarksons 2014; Bulk Carrier Guide 2010).

Table 2-7. Capacity and Draft for Bulk Carrier Classes

Vessel Class	Capacity[a] (DWT)	Draft[b] (feet)
Handymax	Up to 60,000	36–39
Panamax	60,000–100,000	42–49
Capesize	100,000 or larger	55

Notes:
[a] Clarksons 2014.
[b] Bulk Carrier Guide 2010.
DWT = deadweight tonnage.

To provide flexibility in site selection for a terminal and to expand the potential customer base for delivery of shipments, the Applicant determined the proposed export terminal must be accessible to several sizes of vessels and, more specifically, must be able to accommodate at least a Panamax-class vessel. To take advantage of economies of scale, the Applicant has determined the proposed export terminal must be capable of supporting vessels in the Panamax class, or larger.

Shiploading Equipment

A single shiploader, sized to efficiently load Panamax vessels and paired with a single ship berth, can support a throughput capacity of 20 MMTPY. The Applicant determined two shiploaders with two berths is an efficient configuration for loading Panamax vessels, and this configuration will support a throughput capacity of 40 to 50 MMTPY.

[11] Dead weight tonnage is a measure of how much weight a ship is carrying or can carry safely. It is the sum of the weights (in tonnes/metric tons) of cargo, fuel, freshwater, ballast water, provisions, passengers, and crew. The term is often used to specify a ship's maximum permissible deadweight when the ship is fully loaded.

2.2.3.3 Transportation Costs

Coal is a world-traded commodity varying in price based on supply and demand and the energy content of the coal. The cost of coal includes the cost of mining the coal and transporting it from the source to the user. Between the United States and Asia, transportation costs include costs for rail and/or trucking coal from the mine to an export terminal and the costs for shipping the coal by vessel overseas to Asia.

The proposed export terminal would be used to transfer coal owned by others from rail to ocean-going vessels. The companies owning the coal would be responsible for the cost of transporting coal by rail to the terminal, and the coal companies or their clients would be responsible for the cost of shipping the coal to Asian markets. The cost of transportation is affected in part by the location of the shipping terminal relative to the source coal mines, which determines the rates charged by the railroads, and the proximity of the shipping terminal to Asian markets, which determines the travel distance and travel time for shipping companies to transport the coal to Asia.

Transportation rates and their effect on the delivered price of coal are critical factors in the economic viability of the proposed export terminal. The costs to transport coal by rail and by vessel are described in the sections that follow.

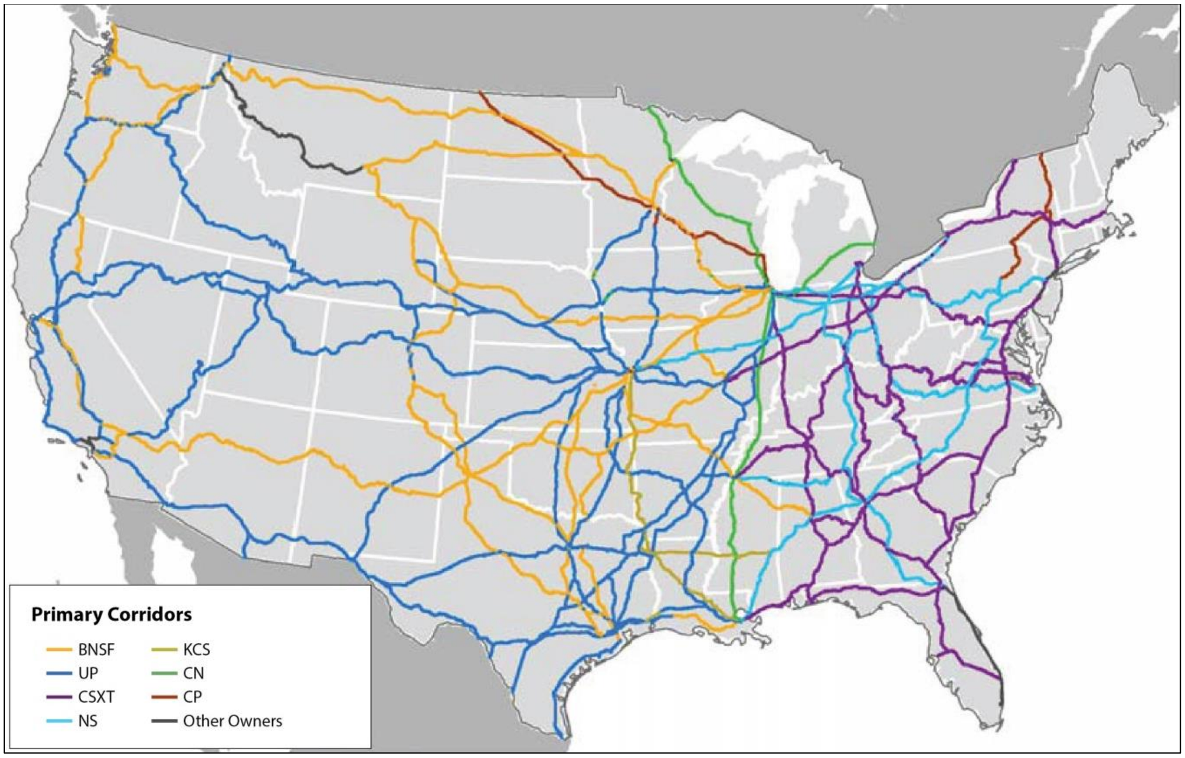
Rail Transportation Rates

Methods of transporting coal from the mine depend on the distance to be traveled. Over short distances, coal is generally carried by trucks, while trains are typically used for carrying coal over longer distances (World Coal Institute 2005; American Association of Railroads 2014). Trains are more fuel-efficient, cleaner, and cost-effective than trucks, especially over long-distance hauls (ICF International 2009). Nearly all coal transported by rail is carried by unit trains, which are freight trains made up of rail cars carrying a single commodity, all with the same origin and same destination, without being split up or stored en route (American Association of Railroads 2014). Unit trains operate around the clock, use dedicated equipment, generally follow direct shipping routes, and have lower costs per unit shipped than non-unit trains (American Association of Railroads 2014).

Powder River Basin coal is expected to be the primary coal transloaded by the proposed export terminal because the mine holdings of the Applicant's parent company—Lighthouse Resources, Inc.—is concentrated in the Powder River Basin. Powder River Basin coal, which is mined from large surface coal mines with thick coal seams near the ground surface, is produced at a lower price per ton when compared to coal from other regions in the United States.

Rail transportation costs, however, are substantial. Two railroads, the BNSF Railway Company (BNSF) and Union Pacific Railroad (UP), move most of the coal along primary freight rail mainlines throughout the western United States (Figure 2-4). Rates for moving freight by rail vary based on the cost of fuel, labor, and equipment. Rates can also be higher on heavily used routes, and can increase based on the time-sensitivity of the cargo, which can also influence priority among trains.

Figure 2-4. Location Map for Primary Freight Railroads



Source: Cambridge Systematics, Inc. 2007.

The length of the haul route plays an important role in determining transportation costs for freight shipments of coal (Surface Transportation Board 2009). Rail rates for delivering coal from different source mines to West Coast shipping terminals are not readily available; however, EIA provides extensive data on actual rail rates for deliveries of coal from different regions to coal-fired power plants throughout the United States (U.S. Energy Information Administration 2012b). For this reason, the rail transportation rates for moving coal to power plants located on the West Coast are used as a point of comparison to determine the transportation rates for moving coal to West Coast shipping terminals. Table 2-8 summarizes the rail transportation rates for moving coal from Powder River Basin and Uinta Basin mines to power plants in California, Oregon, and Washington for the years 2008 through 2010.

Rail rates for transporting Uinta Basin coal to California power plants are substantially higher than the rates to transport Powder River Basin coal to Washington or Oregon. One reason for this is because customers in California ship smaller volumes of coal compared to customers in Washington and Oregon; however, the greater distance to transport Powder River Basin coal to California compared to the distance to transport Uinta Basin coal to California is also a factor.[12] Similar to shipping coal overseas, transporting coal by rail will result in higher rates with longer distances.

[12] As a point of comparison, the distance to transport Powder River Basin coal to Longview, Washington, is approximately 1,307 miles, where the distance to transport Powder River Basin coal to Sacramento and Long Beach, California, is approximately 1,650 miles and 1,781 miles, respectively (BNSF Railway Company 2016).

Table 2-8. Rail Transportation Rates in Real Dollars[a] per Ton[b] for Coal from Mine to Power Plants (2008–2010)

	California[e]			Oregon[f]			Washington[g]		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Basin to State[c]									
Powder River Basin	--[h]	--	--	W[i]	$16.94	$15.69	$23.69	$23.02	$23.92
Uinta Basin	$27.04	$29.74	$34.07	--	--	--	--	--	--
State to State[d]									
Wyoming	--	--	--	W	W	W	W	$23.31	$24.46
Colorado	X[j]	$34.20	$46.22	--	--	--	--	--	--
Utah	$27.04	$29.62	$33.37	--	--	--	--	--	--

Notes:
a Prices adjusted for inflation. Real values were derived by EIA using the GDP Chain-type Price Index, 2005=100.
b Refers to short tons.
c Source: U.S. Environmental Information Administration 2012b: Table 14.
d Source: U.S. Environmental Information Administration 2012b: Table 28.
e Central and southcentral California.
f Boardman, Oregon.
g Centralia, Washington.
h No data were reported to the U.S. Environmental Information Administration or that the value was not applicable.
i Data were withheld from the U.S. Environmental Information Administration.
j No deliveries were reported to the U.S. Environmental Information Administration.

If the rates for Uinta Basin coal are used to estimate transportation costs of shipping Powder River Basin coal to California, the cost would reflect the additional haul distance of approximately 850 track miles between the Uinta Basin and the Powder River Basin. Assuming BNSF and UP charge approximately $0.015 per ton-mile (U.S. Energy Information Administration 2012b; McAllister 2013), coal delivered to California from the Powder River Basin would cost $12.75 more per ton-mile[13] than coal delivered from the Uinta Basin (Table 2-9). This could be one reason why coal from the Powder River Basin is not typically used by the California power sector, and why coal from the Uinta Basin is not typically used in Oregon and Washington (U.S. Energy Information Administration 2012b). Additionally, the rail track network in the western United States limits the number of efficient routes connecting the two coal regions with the West Coast. Ports in California are more closely linked by rail to the Uinta Basin, and ports in the Pacific Northwest are more closely linked by rail to the Powder River Basin (Figure 2-4).

The lower cost for moving Powder River Basin coal to Washington or Oregon means a terminal located in the Pacific Northwest could transport Powder River Basin coal to Asian markets at more competitive prices compared to transporting Powder River Basin coal from a terminal located in California.

[13] Ton-mile is 1 ton of freight carried 1 mile.

Table 2-9. Average Rail Transportation Rates[a] per Ton for Coal from the Powder River Basin to Power Plants

	California		Oregon		Washington	
Basin, State	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**
Powder River Basin (PRB)	--[b]	--	$16.94	$15.69	$23.02	$23.92
Uinta Basin (UB)	$29.74	$34.07	--	--	--	--
Wyoming (PRB)	--	--	$16.94	$15.69	$23.31	$24.46
Colorado (UB)	$34.20	$46.22	-	--	--	--
Utah (UB)	$29.62	$33.37	--	--	--	--
Average	$31.19	$37.87	$16.94	$16.69	$23.17	$24.19
Correction for Haul Distance from the PRB[c]	+$12.75	+$12.75	--	--	--	--
Estimated Rate from the PRB, per ton	$43.94[e]	$50.62[5]	$16.94	$16.69	$23.17	$24.19
Estimated Rate from the PRB, per tonne[d]	$48.44[5]	$55.80[5]	$18.67	$18.40	$25.54	$26.66

Notes:

[a] Based on transportation cost data in Table 2-8.

[b] No data were reported to the EIA or that the value was not applicable.

[c] The track distance between Utah Railway Junction, Utah, and Gillette, Wyoming, is ~850 miles (BNSF Railway 2014) at a cost of $0.0150/ton-mile = $12.75.

[d] One tonne = 1.1023 tons.

[e] Approximate cost of hauling Powder River Basin coal to the ports of Stockton, Richmond, and Sacramento, California; no rate data was provided by EIA for transporting coal to the vicinity of the port of Long Beach, California.

PRB = Powder River Basin; UB = Uinta Basin

Trans-Pacific Shipping Rates

A high level of competition exists between shipping companies for trans-Pacific shipments. As a result, the shipping rates for transporting coal across the Pacific Ocean are highly variable and based on market demands. The total shipping cost is based on a per-ton freight rate for the coal and a daily charter rate for the vessel (Gambrel 2013; McAllister 2013).

Due to the relationship between shipping cost and travel time, sailing distance and shipping time can be used to compare the cost differences for shipping coal between different geographic regions along the U.S. West Coast and Asian markets (Table 2-10). Additionally, because international shipping is a world market, differences in sailing distances and shipping times can be used to compare shipping costs to Asian markets from the U.S. West Coast and competing coal supply regions (e.g., Newcastle, Australia, and Samarinda, Indonesia) (Table 2-10, Figure 2-5).

Table 2-10. Approximate Sea Distances and Transit Times on World Shipping Routes[a]

	Destination											
	Sea Distance in nautical miles (Shipping Time[b] in days)				Shipping Time Relative to Samarinda, Indonesia[c]				Shipping Time Relative to Newcastle, Australia[d]			
Origin	Guangzhou, China	Kaohsiung, Taiwan	Incheon, South Korea	Aichi, Japan[j]	Guangzhou, China	Kaohsiung, Taiwan	Incheon, South Korea	Aichi, Japan	Guangzhou, China	Kaohsiung, Taiwan	Incheon, South Korea	Aichi, Japan
Cherry Point, Washington[e]	5,826 (20.2)	5,488 (19.1)	4,996 (17.3)	4,358 (15.1)	3.37	3.54	2.01	1.70	1.29	1.30	1.05	1.02
Longview, Washington[f]	5,837 (20.3)	5,517 (19.2)	5,062 (17.6)	4,404 (15.3)	3.38	3.56	2.04	1.72	1.29	1.30	1.07	1.03
Vancouver, Washington	5,876 (20.4)	5,556 (19.3)	5,101 (17.7)	4,443 (15.4)	3.40	3.57	2.06	1.73	1.30	1.31	1.07	1.04
Richmond, California[g]	6,135 (21.3)	5,833 (20.3)	5,330 (18.5)	4,701 (16.3)	3.55	3.76	2.15	1.83	1.36	1.38	1.12	1.10
Long Beach, California	6,446 (22.4)	6,117 (21.2)	5,630 (19.5)	4,982 (17.3)	3.73	3.93	2.27	1.94	1.43	1.44	1.18	1.16
Coal Export Competitors												
Samarinda, Indonesia[h]	1,730 (6.0)	1,569 (5.4)	2,487 (8.6)	2,568 (8.9)	—	—	—	—	0.38	0.37	0.52	0.60
Richard Bay, South Africa[i]	6,316 (21.9)	6,402 (22.2)	7,333 (25.5)	7,564 (26.3)	3.65	4.11	2.97	2.96	1.40	1.51	1.54	1.76
Newcastle, Australia	4,522 (15.7)	4,223 (14.7)	4,752 (16.5)	4,305 (14.9)	2.62	2.72	1.92	1.67	—	—	—	—

Notes:

[a] Source: Sea-distances.org 2015.

[b] Based on vessel speed of 12 knots.

[c] Relative shipping time (in days) between the origin and destination compared to the shipping time between Samarinda and the same destination (e.g., Longview to Aichi (15.3 days) ÷ Samarinda to Aichi (8.9 days) = 1.72). In this example, the shipping time is 72% longer from Longview to Aichi as compared with Samarinda to Aichi.

[d] Relative shipping time (in days) between the origin and destination compared to the shipping time between Newcastle and the same destination (e.g., Longview to Aichi (15.3 days) ÷ Newcastle to Aichi (14.9 days) = 1.03). In this example, the shipping time is 3% longer from Longview to Aichi as compared with Newcastle to Aichi.

[e] Transit distances were calculated to Ferndale, Washington.

[f] Transit distances were calculated to Portland, Oregon (RM 102) and corrected to Longview, Washington (RM 63).

[g] Transit distances were calculated to Martinez, California and are similar for the ports of Richmond, Stockton, and Sacramento, California.

[h] Samarinda was the top coal port for Panamax vessels in 2010, with 600 callings (Lloyd's List Intelligence 2012).

[i] Transit distances were calculated to Durban, South Africa.

j Transit distances were calculated to Yokoaichi, Japan. The Chubu EPCo Hekinan power station (installed capacity of 4,100 million watts) is located in Aichi.

Figure 2-5. Location Map for Trans-Pacific Shipping

Table 2-10 shows Pacific Northwest ports, when compared to other U.S. West Coast ports, are closer to ports in China, Japan, South Korea, and Taiwan. For this reason, in addition to rail-transport rates, the Applicant and other competitors have focused on the Pacific Northwest to locate new export terminals for transporting Powder River Basin coal to Asian markets.

Delivered Cost of Coal from Pacific Northwest Ports in Comparison to Australian and Indonesian Ports

Because of their location, Pacific Northwest ports are well-positioned (relative to Australian and Indonesian ports) to provide western U.S. coal to China, Japan, South Korea, and Taiwan, at competitive rates. Ports in the Pacific Northwest are relatively close to the Powder River Basin in comparison to other U.S. ports. Railroad shipping costs are approximately $24.00/ton (in 2010 dollars) to deliver to terminals in Washington State (Table 2-8). The proximity of low-cost subbituminous Powder River Basin coal to Pacific Northwest ports allows this coal to be exported and delivered to Asian customers on a competitive cost basis.

The ocean-going shipping distance to Asian markets from the Pacific Northwest is similar to the shipping distance from coal export terminals in Australia; however, the shipping distance is somewhat farther when compared to distances from export terminals in Indonesia. Although the shipping distance from export terminals in the Pacific Northwest is greater than the shipping distance from export terminals in Indonesia, because ocean freight costs are a relatively small component of the delivered price of coal, the total delivered cost of Powder River Basin coal can be competitive with similar heat value subbituminous coal from Indonesia.