Sightline Institute Comments on the
Draft Environmental Impact Statement for Millennium Bulk Terminals-Longview

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Sightline Institute is a think tank that provides original analysis of energy, economic, and environmental policy in the Pacific Northwest. Sightline submits these comments on the Millennium Bulk Terminals-Longview Draft Environmental Impact Statement (MBTL-DEIS, or simply DEIS) in hopes both of improving the final Environmental Impact Statement and of informing the broader debate about coal export proposals in from the US west coast. Our comments focus on two technical reports prepared under the State Environmental Policy Act (SEPA): the SEPA Greenhouse Gas Emissions Technical Report (GHG-TR), and the SEPA Coal Market Assessment Technical Report (CMA-TR).

Sightline's comments are divided into three themes: **appreciation** for valuable contributions of the MBTL-DEIS, particularly in comparison with previous analyses of coal market dynamics; **significant implications** of the DEIS findings; and substantive **critiques** of the MBTL-DEIS.

APPRECIATION

Many of our comments offer critiques of the DEIS—including its data sources, methods, assumptions, and lack of transparency. Still, there is much to praise in the DEIS, particularly compared with comparable impact statements from other coal projects in recent years. Below, we cite three major areas in which the MBTL-DEIS improves on prior analyses of coal export market dynamics.

1. **The MBTL-DEIS correctly recognizes that coal exports aren't financially viable in today's seaborne coal market.**

The GHG-TR states on p. 3-9, section 3.1.3.2:

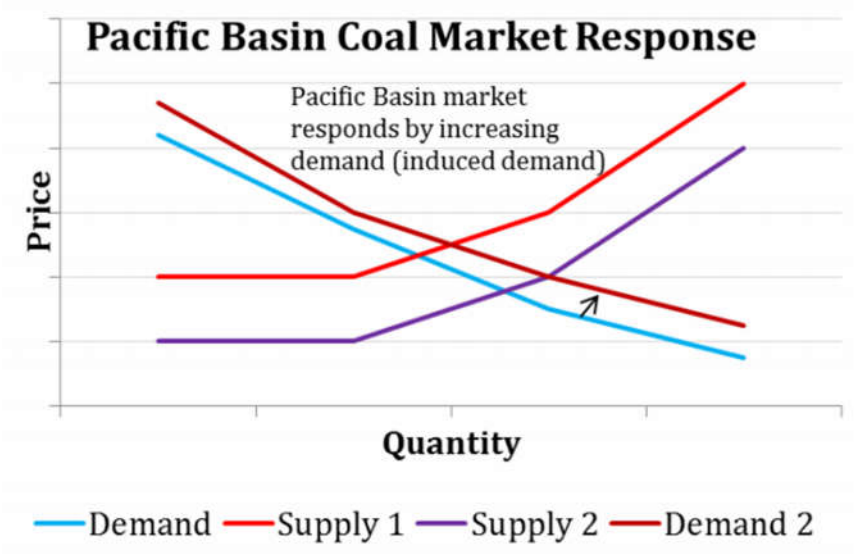
> Delivered prices to Japan…suggest that ***Powder River Basin coal would have a difficult time being cost-competitive, if shipped through the Pacific Northwest to Japan or other Pacific Basin countries, until international coal prices increase.*** [Emphasis added.]

The DEIS correctly recognizes that Powder River Basin (PRB) coal exports simply can't compete at today's low seaborne coal prices. This is corroborated by the fact that PRB coal exporter Cloud Peak Energy announced last fall that it would halt all coal exports for 3 years, citing accelerating losses from selling coal into an oversupplied Pacific Rim market. Coal producers from outside the PRB face similar struggles: Signal Peak Energy and Bowie Resource Partners have also curtailed exports in the face of weak coal prices and chronic oversupply in export markets. And since futures markets currently foresee modest increases in Pacific Rim coal prices through 2022, there is little reason to believe that the economics of coal exports will improve any time soon. The authors of the report should be commended

for a remarkably candid admission that the MBTL project will be financially unviable unless the now-deflated Pacific Rim coal bubble were to re-inflate.

2. The MBTL-DEIS correctly acknowledges that increasing coal exports would boost Asian coal consumption.

Charts on p. 3-15 of the GHG-TR, along with accompanying discussion in the text, accurately describe the market dynamics by which increased US coal exports could stimulate additional demand in Pacific Basin coal markets. One of these charts is shown below:



The MBTL-DEIS acknowledges that a significant increase in coal exports from the US west coast would lower seaborne coal prices in the Pacific Rim, thereby boosting coal consumption in Asia. The magnitude of the increase is subject to debate. But the basic market dynamics are find support both in economic theory and in the historical experience on seaborne coal markets.

This accurate portrayal of market dynamics stands in stark contrast to previous analyses of coal exports. For example, the DEIS for the proposed Tongue River Railroad in Montana (TRR-DEIS) essentially assumed that Asian energy consumption patterns are fixed, and that Asian coal consumers do not respond to prices. The analysis then "concluded" that coal exports would have no effect on Asian coal demand—though that "conclusion" appeared to be nothing more than a consequence of the false assumption about the inelasticity of Asian coal demand. With these errors, the Tongue River Railroad DEIS ignored basic economic theory, disregarded historical experience, and presented dubious and unfounded assumptions as if they were reliable conclusions. Even more shockingly, the TRR-DEIS explored market dynamics in US coal markets in depth, while essentially ignoring market dynamics in Asia.

To its credit, the MBTL-DEIS avoids these fundamental errors by recognizing that a significant boost in seaborne coal supplies would reduce Pacific Rim coal prices, and that low prices in turn would escalate coal demand in Asia.

3. The MBTL-DEIS acknowledges that increasing US coal exports would likely boost global greenhouse gas emissions.

After considering possible dynamics in both domestic and international markets, the MBTL-DEIS concludes that under most reasonable scenarios a significant increase in US coal exports would boost net global greenhouse gas emissions. This conclusion matches the reasonable, common-sense intuition that shipping tens of millions of tons of high-carbon fuels thousands of miles to the world's most energy-hungry economies would cause climate-warming emissions to rise.

However intuitively reasonable this conclusion may seem, it nonetheless conflicts with some previous analyses by the same consulting group that worked on the MBTL-DEIS. Commendably, these consultants have responded to methodological critiques of previous modeling efforts by considering possible market dynamics in Asia as well as the US—particularly the likely increase in Asian coal demand resulting from a significant increase in seaborne coal supplies.

SIGNIFICANT IMPLICATIONS

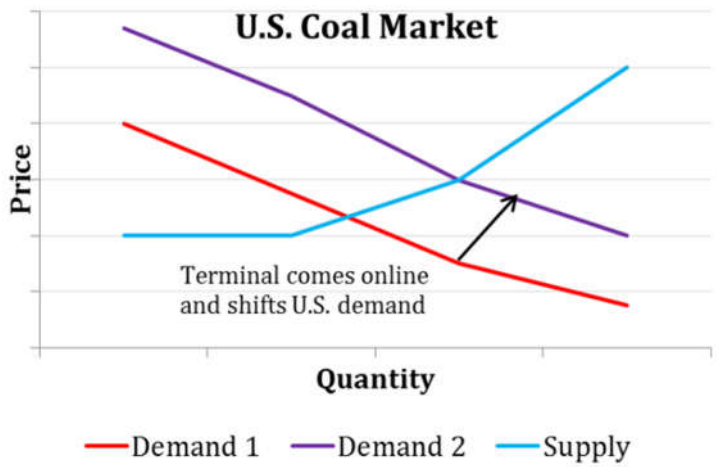
Below we note three important policy and economic implications of the MBTL-DEIS that both the public and policy makers would be wise to take note of.

1. Coal exports would boost domestic coal and power prices.

The discussion on page 3-14 of the GHG-TR clearly and correctly explain an important fact about the US coal industry's plans to expand coal export infrastructure: **boosting exports would raise domestic coal prices**.

> [T]o the extent that Asian coal prices are higher than U.S. coal prices, operation of the Proposed Action would cause Asian coal prices to decline, ***while U.S. coal prices would increase***. [Emphasis added.]

Charts on the same page, including the one below, demonstrate the same point.



Page 3-8 of the GHG-TR expresses the pricing dynamics clearly:

> "Domestic coal prices increase in every scenario in response to the export of Powder River Basin and Uinta Basin coal."

And since the US coal industry sells primarily to electric utilities, higher coal costs generally will be passed on to consumers as higher prices for electricity.

The fact that US coal exports would raise domestic energy prices rarely receives much attention in public debates about coal exports. But it did not escape Wall Street's notice. Several financial analysts have pointed out that coal exports could boost coal company revenue not only by giving US coal companies access to more lucrative overseas markets, but also by raising coal prices on domestic markets. In the unlikely event that Asian coal markets rebounded enough to justify robust US coal exports, the "one-two punch" of higher revenues on export markets and higher prices on domestic markets would substantially boost the fortunes of US coal companies at the expense of US energy consumers.

2. The "Upper Bound" scenario—which has the highest greenhouse gas impacts of any single-terminal scenario considered—is also the only scenario in which coal exports are economically viable.

As discussed above, the MBTL-DEIS admits that coal exports are not economically viable at today's prices. In fact, Cloud Peak Energy, the best positioned Powder River Basin coal exporter, last reported a profit from export sales in the first half of 2013. At that time Asian coal demand was robust and growing, and benchmark Newcastle, Australia coal prices were above $85 per ton. In 2014 Cloud Peak Energy executives stated in an investor conference call that coal prices would have to rise to the $80-90 per ton range for the company to break even on exports.[1] In all likelihood, prices would have to rise even higher

[1] Seeking Alpha, "Cloud Peak Energy's CEO Discusses Q1 2014 Results - Earnings Call Transcript," April 30, 2014, http://seekingalpha.com/article/2175763-cloud-peak-energys-ceo-discusses-q1-2014-results-earnings-call-transcript?part=single

for private capital markets to lend coal port developers the money needed to construct and operate a massive coal export terminal.

Of the four single-terminal scenarios considered in the MBTL-DEIS, the "Upper Bound" scenario is the only one that assumes that international prices would be high enough for economically viable PRB coal exports from the western US. As described in Table 23 of the CMA-TR, the "Past Conditions" and "2015 Energy Policy" scenarios assume that benchmark Pacific Rim coal prices would remain between $60 and $70 per ton—which is too low for even the best positioned PRB coal companies to profit from exports. The "Lower Bound" scenario puts international prices even lower, at $54 to $63 per ton. In contrast, the Upper Bound assumes international prices of at least $90 per ton, which is high enough for Asian exports to turn a profit.

Clearly, a resurgence of west coast coal exports would require a sizable rebound in Asian coal prices and demand. Only the Upper Bound scenario assumes such a rebound in Asian prices and demand; the other 3 single-terminal scenarios assume international price levels far too low to support viable PRB coal exports. In turn, the Upper Bound scenario finds the greatest greenhouse gas impact from US export operations of any scenario considered, with a net increase of 442.7 million tons of greenhouse gas emission over 20 years.

Policymakers would be wise to take note that the only economically viable single-terminal scenario considered by the MBTL-DEIS is also the scenario in which construction of MBTL would lead to particularly large increases in greenhouse gas emissions.

3. Despite the permit denial for the Gateway Pacific project, the Cumulative Scenario may still be relevant.

The MBTL-DEIS lays out a "Cumulative Scenario" that looks at the market dynamics of a full build-out of proposed coal export infrastructure on the US west coast, including not only MBTL but also the proposed Gateway Pacific and Morrow Pacific export projects. The Cumulative scenario showed greenhouse gas impacts that far exceeded even the Upper Bound scenario for the MBTL terminal.

In early May 2016, however, the Army Corps of Engineers denied a key permit for the 48 million metric ton Gateway Pacific coal export terminal. On first blush, it may appear this denial has rendered the Cumulative scenario irrelevant. However, a resurgence of Asian coal demand—which appears highly unlikely but not inconceivable—could also make other coal export terminal proposals viable once again. After all, at the height of the Pacific Rim coal bubble, coal and port companies had proposed three additional coal export terminals with a combined capacity of up to 46 million metric tons. A robust resurgence in international prices could spur similar proposals in the future.

In short, even with Gateway Pacific now out of the picture, the Cumulative Scenario may still offer a useful reference point for gauging the potentially enormous greenhouse gas impact of a full build-out of coal export infrastructure on the North American coast.

CRITIQUES

Notwithstanding our appreciation for the constructive contributions of the MBTL-DEIS, Sightline Institute remains concerned about many of the key elements of the analysis.

1. The MBTL-DEIS relies on a closed, proprietary model with hidden assumptions and methods.

The MBTL-DEIS relies on a complex, propriety model of the US energy system developed by private consulting firm. While the MBTL-DEIS discloses certain inputs to the model, many of key input parameters, methods, and assumptions used in this model remain hidden from view. As a result, the model and its results are untestable, unverifiable and—most importantly—unfalsifiable. This makes it literally impossible to confirm, refute, or even effectively critique the analysis.

Sightline finds it inappropriate for government agencies to rely on closed, proprietary, "black box" models in processes that are designed to inform the public of the consequences of significant public policy decisions. The lack of model transparency clouds key issues, thwarts independent review, and may ultimately undermine public confidence in its results and conclusions.

2. International pricing conditions and market behavior assumed in most of the export scenarios contradict real-world experience and defy rational market behavior.

Table 23 of the CMA-TR describes the four single-terminal market scenarios analyzed in the MBTL-DEIS. Three of these scenarios assume that benchmark Newcastle, Australia coal prices would be at or below their 2014 range of $60-70 per ton. The model runs for these scenarios indicate that coal exports from the proposed MBTL project would total 44 million tons per year.

Simply put, the export results for these three scenarios are preposterous. Unless coal mining and shipping costs were to decline radically, there is simply no way that PRB coal can be profitably exported to Asia when prices are at or below $70 per ton.

Perhaps the best evidence of the absurdity of profitable PRB exports at Newcastle prices of $70 per ton comes from the financial filings of Cloud Peak Energy, widely acknowledged as the best-positioned coal exporter from the PRB. The company's Spring Creek mine has distinct advantages in export markets over competing PRB mines, including comparatively high energy content and short rail distance to existing and proposed ports on the west coast. As a result, Cloud Peak continued to export PRB coal long after rivals Arch Coal and Peabody Energy halted their own PRB exports.

Even with its advantages, though, Cloud Peak began losing money on exports in mid-2013, when Newcastle coal prices fell below $85. By its own admissions, the company only continued to ship coal after mid-2013 because it faced stiff penalties under long-term shipping contracts signed near the peak of the Pacific Rim coal bubble.

Precise export breakeven points for Spring Creek depend on a variety of other factors besides Newcastle prices, including fuel, mining, and shipping costs. Nonetheless, when asked in mid-2014 the price at

which the company could break even on exports, Cloud Peak's CEO stated: "it's between $80 and $90 I think and maybe $85 is as good a number as any."[2]

Since then, however, Cloud Peak's production and transportation costs have declined for a trio of interrelated reasons, all stemming from sharp declines in global energy prices. First, bulk carrier rental costs collapsed as the Pacific Rim coal price bubble deflated and demand for bulk cargo ships waned. Second, falling oil prices reduced the cost of fuel used for mining equipment, rail transportation, and international shipping. Third, lower oil and gas costs led to declines in other mining inputs, such as explosives. Yet even with these tremendous cost reductions, Cloud Peak's CEO recently estimated that Australian benchmark coal prices still must reach at least $75 for the company to break even on exports.[3]

Cloud Peak is in the best economic position of all PRB coal exporters, and its Spring Creek mine can produce no more than 20 million tons per year even under the best market conditions.[4] So it simply strains credulity to think that PRB exporters could profitably ship 44 million tons of coal per year to Asia when benchmark coal prices remain at $70 per ton or below.

Despite the financial absurdity presented in these three scenarios, the CMA-TR makes only one brief nod to the financial difficulties that coal exporters would face from the low international prices foreseen in these export scenarios. Section 6.3.2 states that the "lower international coal prices" assumed in the Lower Bound scenario "would be a challenging market environment for coal transported through the terminal." In the context, "challenging" is an understatement. "Impossible" would be more accurate; and the challenges would be felt not only in the Lower Bound scenario, but also the Past Conditions and Energy Policy 2015 scenarios as well.

Because the MBTL-DEIS relies on a closed, proprietary, "black-box" model, there is simply no way to determine the reasons for the model's failure. Perhaps the model simply assumes that PRB coal companies could profitably export coal when international benchmark coal prices remain below $70 per ton. Perhaps the model is broken, and calculated that PRB coal could price into international markets at those low prices. Perhaps the model presumes that US exporters would be willing to export at a significant loss, or that Asian importers would be willing to pay a steep premium for US coal. Since this model failure currently remains a mystery, there is no way to tell if the specific reasons for the model's erroneous results would affect potential market dynamics in Asia.

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[2] Seeking Alpha, "Cloud Peak Energy's CEO Discusses Q1 2014 Results - Earnings Call Transcript," April 30, 2014, http://seekingalpha.com/article/2175763-cloud-peak-energys-ceo-discusses-q1-2014-results-earnings-call-transcript?part=single.

[3] Seeking Alpha, "Cloud Peak Energy's (CLD) CEO Colin Marshall on Q2 2015 Results - Earnings Call Transcript," July 29, 2015, http://seekingalpha.com/article/3372415-cloud-peak-energys-cld-ceo-colin-marshall-on-q2-2015-results-earnings-call-transcript?part=single.

[4] John T. Boyd Company, "Powder River Basin Coal Resource and Cost Study," September 2011, https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/PSCo-ERP-2011/8-Roberts-Exhibit-No-MWR-1.pdf.

Regardless of the explanation, the MBTL-DEIS model's failure to match economic reality raises deeply troubling possibilities. At best, the model's failure suggests that the entire modeling exercise is deeply flawed. At worst, it suggests that the modeling exercise was intentionally designed to put the economic viability of the terminal in the most favorable possible light. Either way, the findings raise troubling questions about the utility and reliability of the entire MBTL-DEIS modeling exercise, particularly for the scenarios in which international coal prices remain below $70 per ton.

3. The MBTL-DEIS presents puzzling assumptions and findings that are at odds with known market dynamics.

Here are three examples of assumptions and/or findings in the MBTL-DEIS that raise troubling questions about the extent to which the analysis is grounded in reality"

- **The MBTL-DEIS finds that all coal exported from MBTL would be shipped to Japan**. Tables 33, 49, and 81—which present the modeled flows of US coal to Asian markets under the Lower Bound, Past Conditions, and Energy Policy 2015 scenarios—find that all coal 44 million tons of coal exported via MBTL would be purchased by customers in Japan. The text accompanying the tables explains that Japan is the destination for all US coal because it is "the closest destination and thus would allow for the greatest reduction in system costs when the model calculates a solution."

  However, Japan is *already* the closest destination for PRB exports. Yet in both 2013 and 2014 more PRB coal was shipped to South Korea than to Japan.[5] This was because power plants are designed and tuned to burn higher calorie coal from Australia, rather than the lower-calorie coal sub-bituminous coal produced in Indonesia and the PRB. As a result, Japan has imported roughly three times as much coal from Australia as from Indonesia, despite the latter country's proximity advantage.[6] The reverse is true in South Korea, which has many power plants designed to burn sub-bituminous coal; and PRB coal is a good substitute for many grades of Indonesian sub-bituminous thermal coal most commonly consumed in South Korea. At present, then, South Korea is a more fitting destination than Japan for PRB exports.

  The fact that the MBTL-DEIS model finds that PRB coal would find eager buyers in Japan but no buyers whatsoever in South Korea, based solely on shipping distance, suggests that the MBTL-DEIS model lacks the detail, specificity, and real-world market information needed to analyze US coal exports with accuracy.

- **China's coal consumption has declined swiftly, but the MBTL-DEIS scenarios all assume that China's coal appetite will continue to grow**. Chinese coal consumption fell by 2.9 percent in 2014 and 3.7 percent in 2015. Astonishingly, early data suggests that consumption has fallen by

[5] See Westshore Terminals annual reports, http://www.westshore.com/#/financereports.
[6] Hiroyuki Tsuruki, "Flows of Thermal Coal into Asia Ensuring Stable Supplies for Japan," Mitsui & Co., Ltd., 2014, p. 9, http://www.jcoal.or.jp/coaldb/shiryo/material/upload/1-9Mitusi%20Mr.%20Tsurugi.pdf.

more than 8 percent in the initial months of 2016.[7] Even the International Energy Agency, which has been consistently bullish on coal consumption growth, has begun to speculate that Chinese coal consumption has already peaked.[8]

Nonetheless, all of the scenarios examined in the MBTL-DEIS assume that China's coal consumption will rise steadily through at least 2030. (See CMA-TR, Tables 14, 15, 16, 28, 44, 60, 76, and 92.) It is both troubling and confusing that the MBTL-DEIS did not see fit to include scenario that matches today's reality of rapidly declining coal demand in the world's most coal-hungry economy. Even more troublingly, Figure 12 in the CMA-TR portrays China's coal exports only through 2012, even though the Chinese customs agency had published coal import and export data through 2015 by mid-January 2016.[9]

- **The MBTL-DEIS appears to assume that domestic and export coal sales are completely fungible.** The MBTL-DEIS seems to assume that all coal that would be exported to Asia would otherwise be available for sale to domestic customers. Yet it's becoming increasingly clear that West Coast exports would draw from mines that may not be viable for domestic markets.

  As described above, Cloud Peak Energy's Spring Creek mine is currently the best positioned PRB mine for the export market. But Cloud Peak has admitted that there is only a limited US market for Spring Creek coal. When grilled in an investor conference call about why the company was continuing to export Spring Creek coal at a loss instead of selling the coal domestically, the company's CEO said: "there's a finite market for Spring Creek coal domestically. So we would not obviously be able to sell it." Spring Creek coal finds a limited domestic market in large part because its ash is high in sodium, which can corrode power plant boilers and impair generator performance.[10]

  Yet despite the difficulty that Spring Creek and other Northern PRB coals face in domestic markets, Cloud Peak Energy has been pursuing an expanded "export-oriented" mining complex centered on Spring Creek. This suggests that PRB coal companies may be adopting a two-pronged production strategy, targeting specific mines to the domestic market and other mines to export markets.

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[7] Sophie Yeo, "Analysis: Decline in China's coal consumption accelerates," *Carbon Brief,* February 29, 2016, http://www.carbonbrief.org/analysis-decline-in-chinas-coal-consumption-accelerates; Tim Buckley, "15.5% Drop in China Coal Production Shows Transition Gaining Speed," Institute for Energy Economics and Financial Analysis, June 13, 2016, http://ieefa.org/ieefa-note-15-5-drop-china-coal-production-shows-transition-gaining-speed/.
[8] Ambrose Evans-Pritchard, "International Energy Agency sees 'peak coal' as demand for fossil fuel crumbles in China," *The Telegraph,* December 19, 2015, http://www.telegraph.co.uk/finance/economics/12058456/IEA-sees-peak-coal-as-demand-crumbles-in-China.html.
[9] http://www.customs.gov.cn/tabid/49666/Default.aspx
[10] 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.

To the extent that markets for domestic and export coal do not overlap and are not fully fungible, boosting PRB exports may have more limited effects on domestic coal markets than the MBTL-DEIS finds—with exports doing less to increase domestic coal prices and prompting more modest reductions in domestic coal emissions.

4. The Final EIS should provide more information about its model's assumptions and methods.

As it currently stands, the MBTL-DEIS does not contain enough detail to allow for full independent analysis, review, and corroboration of the model's main conclusions. The final version should provide additional information on the model's assumptions, methods, and inputs, including:

- **Coal supply cost curves.** The MBTL DEIS does not specify—or even describe in general terms—coal supply cost curves in either the US or in Asia. This makes it impossible to gauge whether the model accurately represents the likely market dynamics resulting from changes in coal supply, demand, and prices.

- **Price benchmarks.** Table 23 describes pricing assumptions for "International Coal Prices" in different market scenarios. But it does not describe the specific international pricing benchmarks to which it refers. The benchmark matters enormously: prices vary widely depending on the grade of coal, the location of at which it is sold, and the basis in which it is quoted. Throughout our comments, Sightline has assumed that the MBTL-DEIS uses the Newcastle, Australia free-on-board 6,300 kcal/kg Gross-As-Received benchmark, which is the most commonly cited Pacific Rim coal pricing yardstick. But since the MBTL-DEIS does not specify what it means by "international coal prices," it is literally impossible for the public to understand or evaluate the precise pricing and market scenarios being discussed.

- **Economy-wide energy demand response.** The MBTL-DEIS clearly indicates that it considers domestic coal-to-natural gas switching when assessing the effects of coal prices on US electricity markets. However, there is no indication of whether the model explores how changes in US or Asian energy prices alter the *overall* demand for energy. As a result, it is difficult to discern whether the model finds that changes in coal prices affect total energy demand, of if the model simply "reshuffles the deckchairs" among different fuel sources while keeping aggregate demand fixed. And there is no indication of whether it uses different assumptions and methods about aggregate demand in the US vs. Asia.

- **Natural gas fuel switching and cross-elasticities in Asia.** Section 4.2.9 describes the methods used in the MBTL-DEIS to estimate own-price elasticities in Asian gas, coal, and electricity consumption. But there is no indication of how, or even whether, the MBTL-DEIS considered cross-elasticities among those commodities in Asia. As a result, it is not clear whether the DEIS considers potential ripple effects of lower coal prices in Asia, such as increased aggregate demand for electricity, or even decreased demand for natural gas. We are left to wonder, for example, whether gas-to-coal switching in Asian power production is an additional effect of

lower gas prices that the MBTL-DEIS does not account for, or if those effects are covered at least cursorily in the analysis.

CONCLUSION

Despite its methodological shortcomings and lack of transparency, the MBTL-DEIS makes some significant contributions to the literature on the effects of coal exports on greenhouse gas emissions—particularly by looking at the potential market effects of spurring additional coal consumption in Asia. Those effects are ably summarized in the fact sheet on greenhouse gas emissions that accompanies the MBTL-DEIS.[11]

> **Are there significant and adverse impacts that cannot be mitigated?**
>
> The mitigation measures identified above will substantially reduce, but not completely eliminate, the greenhouse gas emissions attributable to the proposed project. ***The proposed project's remaining projected contribution to greenhouse gas emission impacts, which are cumulative in nature, would still be significant and adverse.*** [Emphasis added.]

This is perhaps the most important single finding of the DEIS: that, all else being equal, and after considering both domestic and international market dynamics, a coal export project that could ship 44 million tons of coal per year to the globe's most energy-hungry markets would significantly boost net global greenhouse gas emissions. In the Upper Bound scenario GHG emissions over 20 years could reach as high as 443 million metric tons—nearly five times the annual emissions from all sources in Washington State in 2012.[12] Given these startling figures, Washington policy makers would be wise to take the DEIS as a blaring warning signal that approving the MBTL project could do far more to harm the climate than any other project in the state's history.

[11] Washington State Department of Ecology, "Millennium Bulk Terminals—Longview: Greenhouse Gas Emissions Fact Sheet," http://www.millenniumbulkeiswa.gov/assets/15.-ghg-fact-sheet.pdf.
[12] http://www.ecy.wa.gov/climatechange/docs/2012GHGtable.pdf