



## Northwest Fossil Fuel Exports

Planned facilities would handle five times as much carbon as the Keystone XL Pipeline.

Eric de Place  
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The Pacific Northwest stands squarely between Asian energy markets and large fossil fuel deposits in the interior of North America. In order to reach these markets, energy companies are planning to build a range of large fossil fuel infrastructure projects in the Pacific Northwest.

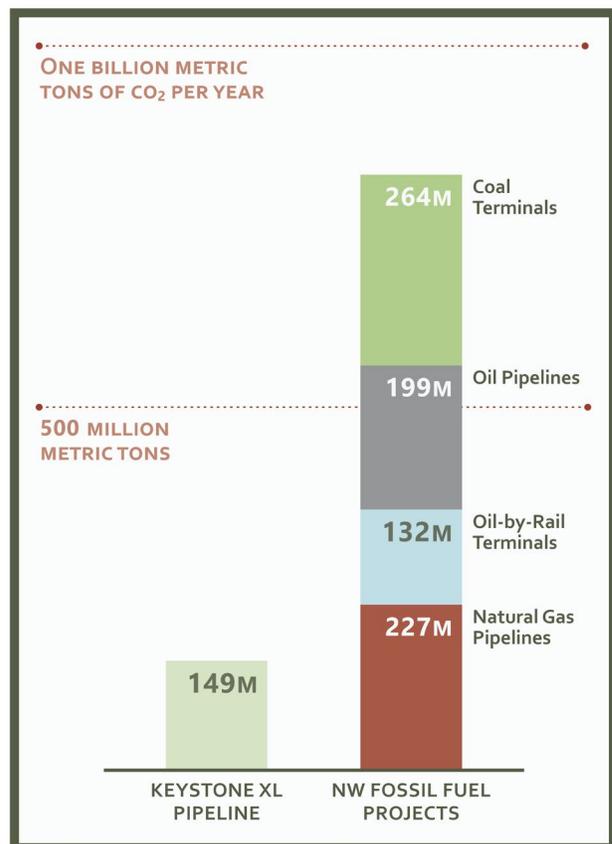
Since 2012, British Columbia, Oregon, and Washington have seen new active proposals for four new coal terminals, three expansions of existing terminals, two new oil pipelines, eleven oil-by-rail facilities, and six new natural gas pipelines.

Each of the projects is distinct, but all can be denominated in a common currency: the tons of carbon dioxide emitted if the fossil fuels were burned. Taken together, these plans would be capable of delivering enough fuel to release 822 million metric tons of carbon dioxide into the atmosphere each year.

For context, consider the Keystone XL pipeline—designed to carry oil from northern Alberta to the Gulf of Mexico—which has earned an international reputation as a first-order climate catastrophe. When burned, the fuel carried by Keystone XL would emit 149 million metric tons of carbon dioxide per year, about as much as is produced by every activity in Oregon and Washington combined.<sup>1</sup>

In other words, if all of the coal export terminals, oil-by-rail facilities, oil pipelines,

### CARBON EMISSIONS FROM BURNING THE FUELS SHIPPED IN PLANNED PROJECTS



and natural gas pipelines planned for the Pacific Northwest are completed and fully utilized, the region could export fossil fuels carrying *five times as much climate-warming carbon as Keystone XL*:

**Coal terminals.** Seven new or expanded coal export terminals would together move 132 million metric tons of coal annually above current levels, enough to emit 264 million metric tons of carbon dioxide per year.

**Oil pipelines.** Two new oil pipelines would be capable of carrying more than 1.1 million barrels per day, enough to emit 199 million metric tons of carbon dioxide annually.

**Oil-by-rail facilities.** Eleven oil-by-rail facilities at refineries or port terminals could move 858,900 barrels per day, enough to emit 132 million metric tons of carbon dioxide each year.

**Natural gas pipelines.** At least six new natural gas pipelines capable of carrying 11.7 billion cubic feet per day would be enough to emit 227 million metric tons of carbon dioxide annually.

## Coal Export Terminals

For years, three coal terminals in British Columbia have exported coal—mostly high-grade steelmaking coal, but also some lower-grade thermal coal—to overseas markets. Coal exporters and terminal operators plan to expand all three of those terminals, while adding a fourth terminal in the lower mainland. Meanwhile, port developers in Washington and Oregon are planning three new terminals, two of which are massive in scale.

These new coal terminals and expansions would have a combined coal-handling capacity of 132 million metric tons per year (mmta).<sup>2</sup> Sightline calculates that each ton of coal would emit an average of 2 tons of carbon dioxide when burned. Therefore, the combined carbon emissions of the coal-shipping projects operated at full capacity would be 164 million metric tons per year.

**From north to south, these projects are:**

**Ridley Terminals expansion (Prince Rupert, BC)** At Ridley Terminals in Prince Rupert, British Columbia, a planned expansion of the existing coal port would allow it to handle up to 25 mmta of coal, an increase of 13 mmta in the site's capacity.<sup>3</sup> In the near term, however, market conditions make it unlikely that the terminal would make use of the expanded capacity.<sup>4</sup>

**Neptune Terminals expansion (North Vancouver, BC)** At Port Metro Vancouver's Neptune Terminals in North Vancouver, site owner Teck, a major Canadian coal company, is planning an expansion of the existing coal terminal that would up the coal-handling capacity to 18 mmta, an increase of 6 mmta.<sup>5</sup>

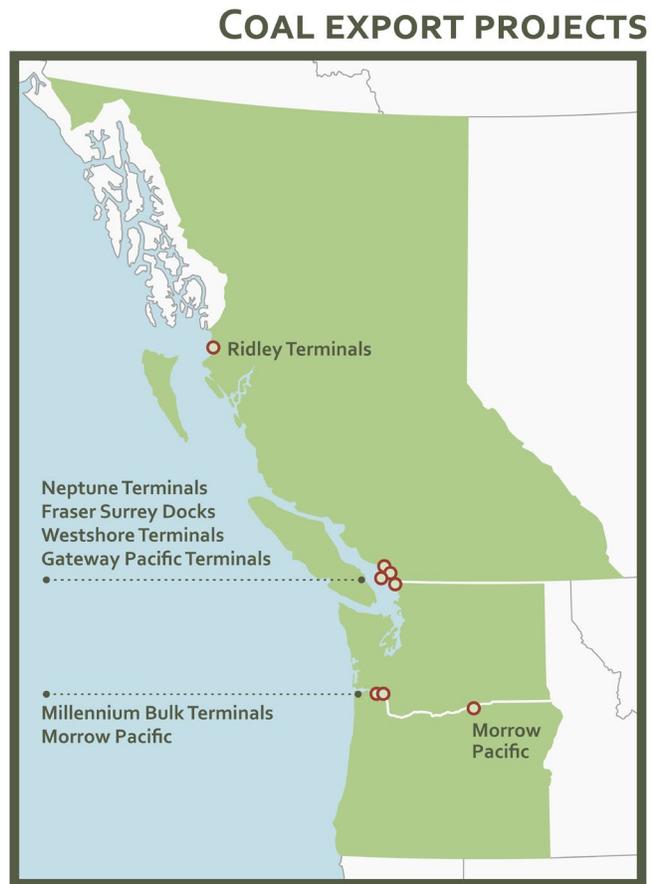
**Fraser Surrey Docks (Surrey, BC)** Planned primarily to accommodate US coal from the Powder River Basin, Port Metro Vancouver's new rail-to-barge coal export facility on the lower Fraser River would have a capacity of 8 mmta.<sup>6</sup>

**Westshore Terminals expansion (Roberts Bank, BC)** Also part of the Port Metro Vancouver complex, the Westshore Terminals near Roberts Bank, BC, just north of the US border, completed a 5 mmta expansion in 2013, bringing the site to a total coal-handling capacity of 33 mmta.<sup>7</sup>

**Gateway Pacific Terminal (Ferndale, WA)** The proposed Gateway Pacific Terminal near Ferndale, Washington, would be the largest coal export facility in North America with a capacity of 48 mmta, plus an additional 6 mmta in capacity for dry bulk commodities, such as grain, potash, or petcoke. The project has support from Peabody Energy and Cloud Peak Energy, both major players in the Powder River Basin coal industry.<sup>8</sup>

**Millennium Bulk Terminals (Longview, WA)** Ambre Energy's proposed Millennium Bulk Terminals at Longview, Washington, would be the second largest coal export facility in North America with a capacity of 44 mmta. The project has attracted backing from Arch Coal, but both Ambre and Arch are navigating rough financial waters.<sup>9</sup>

**Morrow Pacific (Boardman, OR and Clatskanie, OR)** Ambre Energy's proposed Morrow Pacific project would use a pair of sites on the Columbia River. The scheme envisions moving coal from trains to barges, which would make their way downriver to a site where the coal would be trans-loaded onto ocean-going vessels. The project would have a capacity of 8 mmta. The project has been denied permits and faces challenges from Oregon Governor Kitzhaber who has publicly said he opposes coal exports from the state.<sup>10</sup>



## COAL EXPORT PROJECTS

<u>Principal operator</u>	<u>Project and location</u>	<u>New coal handling capacity (million metric tons per year)</u>	<u>CO<sub>2</sub> emissions when burned (million metric tons per year)</u>
PRINCE RUPERT PORT AUTHORITY	Ridley Terminals expansion (Prince Rupert, BC)	13	26.0
PORT METRO VANCOUVER	Neptune Terminals expansion (North Vancouver, BC)	6	12.0
PORT METRO VANCOUVER	Fraser Surrey Docks (Surrey, BC)	8	16.0
PORT METRO VANCOUVER	Westshore Terminals expansion (Roberts Bank, BC)	5	10.0
SSA MARINE	Gateway Pacific Terminal (Ferndale, WA)	48	96.0
AMBRE ENERGY	Millennium Bulk Terminals (Longview, WA)	44	88.0
AMBRE ENERGY	Morrow Pacific (Boardman and Clatskanie, OR)	8	16.0
<b>NORTHWEST COAL TOTALS</b>		<b>132</b>	<b>264.0</b>

## Oil Pipelines

The Pacific Northwest is served by several pipelines handling refined petroleum products, but by only a single crude oil-bearing pipeline, Kinder Morgan's Trans Mountain, which runs from Alberta to a port terminal at Burnaby, British Columbia. An arm of the Trans Mountain stretches south into the US to provide crude to the refineries on the north Puget Sound in Washington.<sup>11</sup>

In British Columbia, the oil industry has proposed two new major pipelines that would transport mostly heavy crude oil from the Alberta tar sands fields. Together, these pipelines would be able to transport more than 1.1 million barrels of oil per day (bpd).<sup>12</sup> Assuming that each barrel would produce 0.49 metric tons of carbon dioxide when burned, the volume of tar sands-derived oil planned for the two pipelines would emit roughly 199 million metric tons of carbon dioxide per year.

These projects are:

**Northern Gateway Pipeline (Alberta to Kitimat, BC)** In northern Canada, Enbridge proposes a \$6.5 billion project to build a new 36-inch diameter pipeline that would stretch 730 miles (1,177 km) from Bruderheim, Alberta, to a port terminal at Kitimat, British Columbia, with an initial capacity of 525,000 bpd.<sup>13</sup> Although the project has been fiercely contested by First Nations and environmental advocates, in June 2014 the Canadian federal government provided "conditional approval" of the project.<sup>14</sup> The company hopes that oil deliveries could start by late 2018, but analysts remain divided about whether the project will ever be completed.<sup>15</sup>

**Trans Mountain Pipeline expansion (Alberta to Burnaby, BC)** In southern Canada, Kinder Morgan is proposing to spend \$5.4 billion building a second oil pipeline, 608 miles long (981 km) from Edmonton, Alberta, to a port at Burnaby, British Columbia, along roughly the same route as the existing Trans Mountain Pipeline.<sup>16</sup> The new pipeline would be capable of moving 590,000 bpd in addition to the existing line's rated capacity of 300,000 bpd.<sup>17</sup>

### OIL PIPELINE PROJECTS



## OIL PIPELINE PROJECTS

<u>Principal operator</u>	<u>Project and location</u>	<u>New oil capacity (barrels per day)</u>	<u>CO<sub>2</sub> emissions when burned (million metric tons per year)</u>
ENBRIDGE	Northern Gateway (Bruderheim, AB to Kitimat, BC)	525,000	93.9
KINDER MORGAN	Trans Mountain Expansion (Edmonton, AB to Burnaby, BC)	590,000	105.5
<b>NORTHWEST OIL PIPELINE TOTALS</b>		<b>1,115,000</b>	<b>199.4</b>

### Oil-by-Rail Facilities

A relatively new development in the oil industry, nearly a dozen oil-by-rail proposals have sprung up around the region since 2012. Between the Columbia River and north Puget Sound, 11 refineries and port terminals are planning, building, or already operating facilities that would receive oil trains.

The projects are designed to initially transport light crude oil from the Bakken shale formation in eastern Montana and western North Dakota, though much of the infrastructure could also be used to export Canadian tar sands oil or other sources of crude. If all of the oil-by-rail projects in the Northwest were built, they would be capable of moving 858,900 barrels per day (bpd).<sup>18</sup> If each barrel of light oil produces 0.42 metric tons of carbon dioxide when burned, the volume of oil planned for these facilities would emit at least 132 million metric tons of carbon dioxide per year.

**From north to south, these projects are:**

**BP Refinery (Ferndale, WA)** By far the largest refinery in the Northwest, BP's Cherry Point Refinery is located on Puget Sound. It can refine 230,000 bpd. Plant managers built a \$60 million railcar receiving and unloading facility that enables the refinery to accept 70,000 bpd. It began receiving oil trains in December 2013.<sup>19</sup>

**Phillips 66 Refinery (Ferndale, WA)** Capable of processing 100,000 bpd, the Phillips 66 Ferndale refinery is located on



Puget Sound just south of Cherry Point. It is set to build a railcar receiving facility that will allow the plant to take 35,000 bpd. Refinery officials hope to complete work by December 2014.<sup>20</sup>

**Tesoro Refinery (Anacortes, WA)** Tesoro's Anacortes Refinery sits on Puget Sound at March Point near Anacortes. Capable of refining 120,000 bpd, the company completed a \$55 million rail improvement project in 2012 that allows it to receive 50,000 bpd by railcar.<sup>21</sup>

**Shell Refinery (Anacortes, WA)** The second largest refinery in the Northwest, with a capacity of 145,000 bpd, Shell's Puget Sound Refinery is located just south of the Tesoro Refinery at Anacortes. Officials there are planning a new rail loop and offloading facility that will enable it to handle 60,000 bpd of crude oil delivered by train.<sup>22</sup>

**US Oil Refinery (Tacoma, WA)** Located at the Port of Tacoma, US Oil and Refining Company operates the smallest of the Northwest refineries, with a rated capacity of 39,000 bpd. In 2012, the plant spent \$8 million building a new rail yard. Based on statements from government and refinery officials, Sightline estimates that the facility currently accepts 35,000 bpd brought in on trains.<sup>23</sup>

**US Development Group (Hoquiam, WA)** The US Development Group is planning to spend \$80 million constructing a facility at the Port of Grays Harbor's Terminal 3. Plans call for receiving 50,000 bpd by rail, storing it on-site in tanks, and transferring it to barge or vessel.<sup>24</sup>

**Westway Terminals (Hoquiam, WA)** Westway's proposed terminal is located at the Port of Grays Harbor where it currently operates a methanol handling facility. Westway is planning to spend \$60 million building five additional storage tanks, each big enough to store 200,000 barrels of oil, and develop related oil-handling infrastructure. According to official project documents, the site will be equipped to move roughly 48,900 bpd. The company originally hoped that the site would be operational by January 2014, but legal appeals of the permits have delayed operations.<sup>25</sup>

**Imperium Terminals (Hoquiam, WA)** Imperium, a biodiesel producer, is exploring a crude oil handling facility at the Port of Grays Harbor at the firm's existing site at Terminal 1. The company proposed to spend \$45 million constructing nine 80,000-gallon storage tanks and other facilities in 2014. Based on rail and handling estimates reported in its project documents, Sightline estimates that the site will be able to handle roughly 70,000 bpd if it is completed. As with the Westway project, legal appeals have delayed construction.<sup>26</sup>

**NuStar Energy (Vancouver, WA)** NuStar Energy operates fuel storage and shipping operations at several Port of Vancouver terminals. In April 2014, *The Columbian* newspaper reported that the firm had submitted permits that would allow it to convert some of its equipment to handle up to 50,000 bpd of crude oil.<sup>27</sup>

**Tesoro / Savage (Vancouver, WA)** The most ambitious crude oil transshipment scheme in the Northwest is Tesoro's plan to partner with Savage Companies to develop a \$75 to \$100 million rail complex at the Port of Vancouver. The facility would be capable of handling as much as 360,000 bpd. Company officials originally hoped that the site would be operational by 2014, but most observers agree that permitting and review activities will delay the project until 2015 or 2016.<sup>28</sup>

**Global Partners (Clatskanie, OR)** Global Partners purchased a former ethanol plant at Port Westward on the Columbia River. Operators are currently receiving trainloads of crude oil, storing it on-site in two 3.8-million-gallon tanks, and loading it onto vessels or barges. Although Global Partners is legally allowed to handle only 50 million gallons of oil per year, the company has blatantly violated the conditions of its permits by moving far greater quantities. Based on figures reported by the State of Oregon in a March 2014 civil penalty action, Sightline estimates that the site is handling an average of at least 30,000 bpd. State officials are allowing the company to continue operations while it seeks a new permit.<sup>29</sup>

It is conceivable that some portion of the oil scheduled for delivery by rail is intended for domestic consumption and is not, therefore, properly considered an export. Nonetheless, it is likely that the majority of the oil intended for rail delivery is either explicitly for export or, because it would substitute for other sources of oil at domestic refineries, would indirectly encourage crude oil exports from North America. Notably, the volume of crude scheduled for transport to the Northwest far exceeds the region's total refining capacity, and many of the oil-by-rail terminals are remote from US refineries.

Although there is currently a licensing restriction, often referred to as a “ban,” on the export of US crude, the industry is actively lobbying federal policymakers to lift the restriction. Moreover, oil extracted from Canada is eligible for export from US ports under current law.

## OIL-BY-RAIL PROJECTS

<u>Principal operator</u>	<u>Project and location</u>	<u>New oil handling capacity (barrels per day)</u>	<u>CO<sub>2</sub> emissions when burned (million metric tons per year)</u>
BP	BP Refinery (Ferndale, WA)	70,000	10.7
PHILLIPS 66	Phillips 66 Refinery (Ferndale, WA)	35,000	5.4
TESORO	Tesoro Refinery (Anacortes, WA)	50,000	7.7
SHELL	Shell Refinery (Anacortes, WA)	60,000	9.2
US OIL & REFINING	US Oil Refinery (Tacoma, WA)	35,000	5.4
US DEVELOPMENT	Grays Harbor Rail Terminal (Hoquiam, WA)	50,000	7.7
WESTWAY	Terminal Expansion (Hoquiam, WA)	48,900	7.5
IMPERIUM	Bulk Liquid Terminal Facility (Hoquiam, WA)	70,000	10.7
NUSTAR ENERGY	Vancouver Transportation Logistics Improvement (Vancouver, WA)	50,000	7.7
TESORO	Vancouver Energy Distribution Terminal (Vancouver, WA)	360,000	55.2
GLOBAL PARTNERS	Columbia Pacific Bio-Refinery (Clatskanie, OR)	30,000	4.6
<b>NORTHWEST OIL-BY-RAIL TOTALS</b>		<b>858,900</b>	<b>131.7</b>

## Natural Gas Pipelines

Canadian and American energy markets have found themselves awash in a flood of cheap natural gas in recent years, and energy interests have proposed no fewer than six new natural gas export pipelines in the Northwest since 2012. Together, these pipelines would be able to transport at least 11.7 billion cubic feet of natural gas per day (bcfd).<sup>30</sup> If each 1,000 cubic feet of natural gas emits 53 kilograms of carbon dioxide when burned, the volume of natural gas planned for these pipelines would emit roughly 227 million metric tons of carbon dioxide per year.

**From north to south, these projects are:**

**Westcoast Connector Gas Transmission Project (Cypress to Prince Rupert, BC)** Spectra Energy plans to build a 525-mile (850 km) natural gas pipeline from northeastern BC to a liquefaction and export facility operated by BG Group at Ridley Island in Prince Rupert, BC. The line would have an initial capacity of 4.2 bcfd but would be designed to allow for two parallel pipelines that could carry as much as 8.4 bcfd.<sup>31</sup>

**Prince Rupert Gas Transmission Line (Hudson's Hope to Prince Rupert, BC)** The proposed TransCanada Progress Energy Canada project would deliver natural gas from the Montney gas fields of northeastern British Columbia to a port site near Prince Rupert by way of a 560-mile (900 km) pipeline.<sup>32</sup> At the coast, the gas would be liquefied for export by Pacific NorthWest LNG.<sup>33</sup> The pipeline would have an initial capacity of 2.0 bcfd, though the project proponents say they can expand the pipeline to 3.6 bcfd.<sup>34</sup>

**Coastal GasLink (Dawson Creek to Kitimat, BC)** First announced in June 2012, TransCanada's Coastal GasLink pipeline would have an initial capacity of 1.7 bcfd, though it may expand in the future.<sup>35</sup> The line would carry natural gas 400 miles (650 km) in a 48-inch pipe from northeastern BC to Kitimat where it would be processed for export at the LNG Canada facility. The Vancouver Sun has reported that the pipeline's capacity has the potential to double in size.<sup>36</sup>



**Pacific Trail Pipeline (Summit Lake to Kitimat, BC)** The Pacific Trail Pipeline, a co-venture of Apache Corporation and Chevron Canada, would carry natural gas 288 miles (463 kilometers) from Summit Lake to Kitimat as part of the larger Kitimat LNG project, which was announced in December 2012.<sup>37</sup> That project will be allowed to export 10 million tons of LNG on an annual basis, the equivalent of roughly 1.3 bcf.<sup>38</sup> Chevron's publicity materials say that the pipeline could be much larger: up to 4 bcf.<sup>39</sup>

**Oregon LNG (Sumas, WA to Warrenton, OR)** Oregon LNG and Washington Expansion Project (Sumas, WA to Warrenton, OR) In April 2012, Williams Pipeline announced plans for the Washington Expansion Project, 140 miles of new pipeline near an existing natural gas pipeline between Sumas and Woodland, Washington. The new pipeline would be interconnected and interdependent with Oregon LNG, a project that would build a new 36-inch diameter pipeline another 85 miles to Warrenton, Oregon on the mouth of the Columbia River, where the gas would be liquefied for export.<sup>40</sup> The facility would be capable of exporting 1.3 bcf.<sup>41</sup>

**Pacific Connector Gas Pipeline (Malin to Coos Bay, OR)** The Pacific Connector Gas Pipeline project, proposed by energy infrastructure company Williams, would build a new 230-mile pipeline to connect an existing natural gas pipeline hub in eastern Oregon to the planned Jordan Cove LNG Export site at Coos Bay, OR.<sup>42</sup> The project backers have applied for permits to export 1.2 bcf.<sup>43</sup>

## NATURAL GAS PIPELINE PROJECTS

<u>Principal operator</u>	<u>Project and location</u>	<u>New natural gas capacity (billion cubic feet per day)</u>	<u>CO<sub>2</sub> emissions when burned (million metric tons per year)</u>
TRANSCANADA	Coastal Gas Link (Dawson Creek, BC to Kitimat, BC)	1.7	32.9
APACHE / CHEVRON	Pacific Trail Pipeline (Summit Lake, BC to Kitimat, BC)	1.3	25.2
PROGRESS ENERGY	Prince Rupert Gas Transmission Line (Hudson's Hope, BC to Prince Rupert, BC)	2.0	38.8
SPECTRA ENERGY	Westcoast Connector Gas Transmission Project (Cypress, BC to Prince Rupert, BC)	4.2	81.4
OREGON LNG	Oregon LNG Export (Sumas, WA to Warrenton, OR)	1.3	25.2
WILLIAMS	Pacific Connector Gas Pipeline (Malin, OR to Coos Bay, OR)	1.2	23.3
<b>NORTHWEST NATURAL GAS PIPELINE TOTALS</b>		<b>11.7</b>	<b>226.8</b>

### How we calculate carbon emissions, and other notes

All figures in this memo are given in metric units except where noted otherwise; some may not sum due to rounding. In this report, the Northwest refers to British Columbia, Oregon, and Washington.

Although the total carbon capacity of these projects is enormous by any standard, the estimates in this memo both overstate and understate the potential scale of impacts from fossil fuel infrastructure under consideration in the Northwest. Notably, some of the projects are in competition with one another and may be mutually exclusive. Or they face physical constraints, such as vessel traffic limitations in the Salish Sea or rail capacity for coal transport in the US.

Yet on the other hand, this analysis excludes major dimensions of fossil fuel export plans. For example, it does not count refined petroleum product plans such as: new fueling infrastructure planned for

Vancouver, BC's airport; or a liquefied petroleum gas (LPG) shipping facility at Longview, Washington.<sup>44</sup> Nor does it count more speculative projects such as Kinder Morgan's "Northern Leg" oil pipeline; oil-by-rail facilities at Longview, Washington, or Prince Rupert, British Columbia; or County Coal's export scheme.<sup>45</sup> Moreover, the report counts only the capacity currently proposed by project proponents, not the potential for future expansions. What's more, Sightline's carbon figures do not include any of the sizeable "upstream" emissions associated with fossil fuels. A tally of the emissions from extracting, mining, refining, processing, handling, and transporting the fuels would yield a far larger carbon footprint.

To estimate the CO<sub>2</sub> emissions from oil moving via the Keystone XL pipeline, Sightline assumes that a.) the pipeline would operate at full capacity, 830,000 bpd (about 303 million barrels per year), b.) that it would transport diluted bitumen derived from oil sands, and c.) when burned, each barrel of bitumen releases an average of 0.521 metric tons of CO<sub>2</sub> (not counting additional emissions associated with bitumen extraction, upgrading, processing, transporting, handling, or refining), which works out to 158 million metric tons of carbon dioxide.<sup>46</sup> Based on a scientific literature review conducted by the US State Department, Sightline reduced this figure by 6 percent, to 149 million metric tons, to account for the presence of diluent material in the dilbit. For comparison, the State Department estimates in Chapter 4 (page 4.14-4 and following) of the Keystone XL's recently released Environmental Impact Statement that on a "lifecycle basis"—that is, including production and refining, as well as combustion—the pipeline's oil would result in emissions of 147 to 168 million metric tons of carbon dioxide equivalent.<sup>47</sup>

**Coal terminals.** Sightline's carbon estimates do not include any emissions associated with coal mining, processing, transporting, or handling. In estimating expansions of coal export capacity, Sightline excludes all coal terminal capacity and shipping in place prior to 2012, as well as the small amounts of coal shipped from Texada Island and Port Moody, British Columbia. Sightline also excludes the Project Mainstay coal export plan at Coos Bay, Oregon, and Kinder Morgan's Port Westward proposal at the Port of St. Helens, Oregon. Although the Port of Coos Bay has indicated it is still interested in pursuing the plan, all of the project's investors have backed out.<sup>48</sup> Kinder Morgan has said publicly that it is still planning to export coal from the Northwest, but the firm has officially abandoned its Port Westward plans and has declined to name an alternative site.<sup>49</sup>

Sightline estimates that each ton of coal shipped from new terminals and terminal expansions would produce 2 tons of CO<sub>2</sub> on average, a figure that is consistent with data published by the US Energy Information Administration (EIA) and by Environment Canada.<sup>50</sup>

**Oil pipelines.** Sightline's carbon estimates do not count some important dimensions of these projects, such as a condensate pipeline proposed by Enbridge as part of the Northern Gateway project. That line would be built parallel to the oil pipeline and would be capable of moving 193,000 bpd east to provide diluent material for the west-bound diluted bitumen (often called "dilbit"). Note that the US State Department calls the Northern Gateway oil pipeline "easily expandable" to 800,000 bpd, though that expansion does not appear to be part of the current official proposal. Additionally, the Trans Mountain pipeline expansion would allow for a further expansion of 240,000 bpd.<sup>51</sup> Sightline counts neither of these expansion potentials. Sightline's estimates also do not account for emissions associated with

bitumen extraction, upgrading, processing, transporting, handling, or refining. Nor do they include the emissions from coal-fired power plants' combustion of low-price petroleum coke, which is derived from bitumen refining and upgrading.<sup>52</sup>

Sightline estimates that the proposed pipelines transport Canadian oil sands-derived dilbit that is composed of 70 percent bitumen and 30 percent diluent, which are typical industry figures.<sup>53</sup> When burned, Sightline estimates that a barrel of bitumen releases an average of 0.521 metric tons of CO<sub>2</sub>, based on research by Deborah Gordon at the Carnegie Endowment for International Peace.<sup>54</sup> In order to account for the presence of diluents, which are hydrocarbons that are processed and/or transported before being blended with pure bitumen for pipeline transport, Sightline reduced the CO<sub>2</sub> estimates by 6 percent in order to conform to findings from the US State Department, which concluded based on a scientific literature review that diluted bitumen is 4 to 7 percent less carbon-intensive than pure bitumen on a "well-to-wheels" basis.<sup>55</sup> (Sightline's carbon estimates are the mathematical equivalent of assuming that the diluent material is approximately 20 percent less carbon-intensive than raw bitumen.)

There are additional layers of uncertainty in evaluating the carbon content of oil transported in these pipelines. For example, the US State Department notes that the overall greenhouse gas profile of dilbit can actually be higher than for raw bitumen, depending on the nature and uses of the diluent material. What's more, the proposed oil pipelines may transport fuels produced from a range of different sites, and the carbon content of different bitumen products may vary. Also, estimates of the carbon intensity of bitumen fuels vary.<sup>56</sup>

**Oil-by-rail facilities.** Sightline's carbon estimates do not account for emissions associated with shale oil extraction, which in the Bakken fields typically employs fracking techniques; nor do they account for the flaring of excess hydrocarbons; nor for processing, transporting, handling, or refining the oil. Sightline's estimates assume that the oil trains transport light oil. When burned, Sightline estimates that each barrel of light oil releases an average of 0.42 metric tons of CO<sub>2</sub>, based on research by Deborah Gordon at the Carnegie Endowment for International Peace.<sup>57</sup> Oil trains may transport fuels produced from a range of different sites, and the carbon content of these oils may vary considerably. For example, several of the oil-by-rail facilities inventoried here are configured to accept heavy oil from the Canadian tar sands, such as bitumen (or a specific type of diluted bitumen known as "railbit," or other types of synthetic or blended oils) and bitumen is roughly 24 percent more carbon-intensive than light oil. In fact, at least some of these sites may already be receiving small volumes of tar sands-derived oil.

**Natural gas pipelines.** Sightline's carbon estimates do not include emissions from extraction, transporting, processing, storing, or handling the natural gas, nor from venting or other fugitive emissions. In conducting this analysis, Sightline applied an additional level of scrutiny to natural gas transport projects, counting only those that are in active development and counting only initial planned capacity rather than the full capacity the projects are designed for. According to the US Energy Information Administration, burning 1,000 cubic feet of natural gas produces 53.1 kilograms of CO<sub>2</sub>.<sup>58</sup>

## About the Author

**Eric de Place** is policy director at Sightline Institute, where he leads the center's work on issues related to coal and oil infrastructure.

**Sightline Institute** is an independent, non-profit think tank based in Seattle.

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## Notes and Sources

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