Technical Appendix to Expert Testimony on the Need for the Vancouver Energy Distribution Terminal: Market Analysis

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In the Matter of: Application No. 2013-01
TESORO SAVAGE, LLC
VANCOUVER ENERGY DISTRIBUTION TERMINAL

CASE NO. 15-001
BEFORE THE STATE OF WASHINGTON ENERGY FACILITY SITE EVALUATION COUNCIL

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1 Introduction

This Market Analysis for the VEDT considers in detail the WA and CA[1] refinery markets as potential destinations for crude handled by the VEDT. There is also a limited consideration of the AK and HI refinery markets, which are small and unlikely to be significant destinations for crude handled by the VEDT.

This Market Analysis for the VEDT also provides a non-exhaustive consideration of tar sands (AB) and Bakken (ND) as potential origins for crude handled by the VEDT, and CA and Asia as potential destinations.

[1] Abbreviations for states and provinces (e.g., "WA" for "Washington" and "BC" for "British Columbia") are often used for brevity throughout this Technical Appendix.

2 Washington Refinery Market

2.1 Refineries, Logistics, and Oil Supply

WA's extensive energy facilities include five oil refineries, as well as extensive energy logistics facilities[2] relating to those refineries. WA refineries and energy logistics facilities not only supply WA, but also provide sizable energy supply to neighboring states and international markets.[3]

WA has a combined refining capacity of 657 kbpd.[4] The output of WA refineries greatly exceeds WA consumption. So WA refineries are in part an export industry; and **WA is a sizable net exporter of refined petroleum products**.[5]

According to WA's Department of Commerce:

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[2] For the petroleum industry, **energy logistics facilities** are the facilities associated with the midstream sector, which involves the transportation (by pipeline, rail, barge, tanker or truck), associated transloading and storage of crude or refined petroleum products. Thus energy logistics facilities can be pipelines or transportation vessels (rail, barge, tanker or truck), terminals (rail, marine, truck, pipeline) and storage. Typically an energy logistics facility involves some combination of transportation, terminals and storage.

[3] WA refineries process crude oil into gasoline and other refined products. WA energy logistics facilities move crude into refineries. Other WA energy logistics facilities move products out of the refineries to WA consumers and to markets outside WA.

[4] Capacity is 657 kbpd for Barrels per Stream Day (maximum full capacity under optimal conditions with no allowance for downtime); capacity is 631 kbpd for Barrels per Calendar Day (capacity under usual operating conditions with some allowance for maintenance and other limitations that reduce production). Stream day capacity is typically about 4 to 8% higher than calendar day capacity and about 13-17% higher than actual crude inputs (due to downtime under actual operating conditions).
http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_SWA_a.htm;
U.S. Energy Information Administration, PADD 5 Transportation Fuels Market, September 2015, pp. 22, 36. Accessed May 1, 2016.
http://www.eia.gov/analysis/transportationfuels/padd5/pdf/transportation_fuels.pdf, pp. 22, 36;
State of Washington Department of Commerce, Petroleum Supply and Use in Washington State, October 2013. http://www.commerce.wa.gov/Documents/Petroleum-Whitepaper-7-15-2013.pdf p. 29.

[5] Large volumes of refined products flow out of WA, but there are small flows into the state, due to logistical and other factors. Eastern WA receives refined products via pipelines from UT and MT refineries; WA refineries import some products as feedstocks and to balance product slates.
State of Washington Department of Commerce, 2012 Washington State Energy Strategy, December 2011. http://www.commerce.wa.gov/Documents/EO2012WAEnergyStrategy.pdf p. 7;
State of Washington Department of Commerce (2013), p. 29;
WA State, Department of Ecology, Washington 2014 Marine and Rail Oil Transportation Study, March 1, 2015, https://fortress.wa.gov/ecy/publications/SummaryPages/1508010.html
EIA (2015), pp. 35-41;
Washington Research Council, The Economic Contribution of Washington State's Petroleum Refining Industry in 2013, on behalf of Western States Petroleum Association, December 2014, http://researchcouncil.org/files/docs/2014/12/2014-refinery-report-final-122914.pdf pp. 4-8, 16, 22.

> These refineries produce more refined product than is needed by Washington State. In 2011 approximately 35 percent of the combined refinery output was sent to domestic consumers, mainly in Oregon and California. Approximately 14 percent was shipped to foreign consumers, mostly to British Columbia.[6]

So not only do the Washington refineries supply the refined petroleum products needed in Washington, about **half of their combined refinery output goes to other states and countries**.

WA's extensive oil energy facilities (including refineries and energy logistics facilities) already supply Washington State energy consumers "with abundant energy at reasonable cost." The capacity of WA refineries has not significantly changed in recent years, and it is not expected to change in the future.[7] Likewise, the overall crude supply processed by WA refineries has remained steady at about 560 kbpd, and it is not expected to change in the future.[8]

With the energy logistics facilities now in place, WA refineries have been able to access sufficient crude supply. WA refineries have been operating at full capacity, more than meeting the state's energy needs, and sending half their output to consumers outside WA. The VEDT is not needed to provide crude supply to WA refineries, and it is certainly not needed to provide refined products to WA consumers.

The extensive energy logistics facilities related to the refineries include the marine and pipeline infrastructure that until recently was the source of all crude supply to those refineries. More recently, these logistics facilities have expanded to include crude by rail (CBR) unloading terminals.

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[6] State of Washington Department of Commerce (2013), p. 9. Data for 2011 in this source are very similar to data for 2013 in Washington Research Council (2014), pp. 4, 7-8. EIA (2015) determines that WA refinery production more than meets all regional demand in both WA and OR and regularly provides supply to other states: "This production was sufficient to meet 91% of regional demand for motor gasoline (102% when blended with ethanol), 163% of jet fuel demand, and 138% of distillate fuel demand. Production from refineries in Washington State regularly supplies Alaska and California." (p. 36)

[7] State of Washington Department of Commerce (2013), pp. 30-31, 48; Washington Research Council (2014), pp. 6, 8, 18.

[8] See footnote 7.

WA's crude supply comes from four sources via seven routes:[9]

Source and Type of Crude	Route
Alaska (Alaska North Slope or (ANS))[10]	1. by tanker to the refineries
Canadian crude from AB (heavy, medium and light)	2. by Trans Mountain Mainline Pipeline to Abbotsford, BC and then by Kinder Morgan's Puget Sound pipeline system to the refineries 3. by Trans Mountain Mainline Pipeline to the Westridge Terminal in Burnaby BC and then by barge to the refineries 4. by rail to refineries in Puget Sound
Inland US, mostly Bakken (mainly light shale crude)	5. by rail to refineries in Puget Sound 6. by rail to marine transload terminals and then by barge to Puget Sound
Overseas imports from Latin America, the Middle East, and other global sources (a mix of heavy, medium and light)	7. by tanker to the refineries

The above table demonstrates that WA already receives crude from multiple sources. WA refineries can and do process a range of crudes, including heavy crudes, as well as medium and light crudes.[11] With capability to access and process a range of crudes, WA refineries have continued to operate at full capacity under a wide range of evolving market conditions.

There have been major shifts in crude sourcing for WA refineries since 2003, but the shifts going forward could be more limited and gradual.

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[9] Sources for Table: Muttit, Greg and Lorne Stockman, Tracking Emissions: The Climate Impact of the Proposed Crude-by-Rail Terminals in the Pacific Northwest, Oil Change International and Sightline Institute, November 2015. pp. 14-16. Accessed March 30, 2016. http://priceofoil.org/2015/11/10/tracking-emissions-the-climate-impact-of-the-proposed-crude-by-rail-terminals-in-the-pacific-northwest/
Note: The above-cited document will be referred to as "The OCI Tracking Emissions Report" in the TGG Expert Report.

[10] ANS is a medium crude (API gravity 31°), but has some properties more similar to heavy crudes (notably a high proportion of heavy (bottom of the barrel) components). See footnotes 11, 16, and 43.

[11] Two of five WA refineries (BP and Shell) have cokers, used to upgrade heavy (bottom of the barrel) components into lighter, more valuable products (notably transportation fuels). The other three WA refineries (Tesoro, Phillips 66, and US Oil) produce substantial amounts of heavy products (heavy fuel oil, notably for ships, but also for export, and asphalt). Hence, WA refineries can process crudes with sizable heavy components (traditionally ANS; but also tar sands heavy crudes and ANS look-alikes (notably tar sands dilbit blended with Bakken). See OCI Tracking Emissions Report, pp. 15-16; footnotes 10 and 16; and http://www.eia.gov/todayinenergy/detail.cfm?id=26132.

The biggest change has related to the decline in Alaska North Slope production. Following development of the Trans-Alaska Pipeline System (TAPS) and large-scale crude production, ANS by tanker became the dominant supply for WA refineries.[12] ANS production peaked in 1988 and by 2003 had dropped by about half. Nonetheless, ANS was still providing over 90% of WA refinery crude supply in 2003. Since then, Alaskan production and supply to WA have fallen by half, such total ANS production is now less than 25% of peak and ANS provides about 45% of WA crude supply. ANS by tanker now provides about 250 kbpd of crude supply for WA.[13]

Meanwhile, Canadian crude supply to WA refineries by pipeline has grown, rising from less than 10% in 2003 to about 25% from 2011 onward. **Canadian crude by pipeline now provides about 140 kbpd of supply for WA.**

There has been even more growth in crude by rail, notably to access Bakken crude. CBR was not a significant crude source for WA refineries prior to 2011. And in 2011 and the first half of 2012, CBR was still only about 2% of total supply. But since, CBR has grown to provide about 25% of WA crude supply. **Bakken and other crude by rail now provide about 140 kbpd of supply for WA.**[14]

WA also receives some foreign (non-Canadian) crude supply by tanker from a variety of global sources, But with the growth in supply from CBR, these other imports are now

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[12] EFSEC, Order and Recommendation, Application 76-2, Northern Tier Pipeline, Order 636, January 27, 1982, pp. 9-14. Accessed April 30, 2016. http://www.efsec.wa.gov/FILES/orders/636.pdf

[13] NB: the data provided in this Technical Appendix are intended to be representative and are sometimes estimated, adjusted, and approximated; these data are based on extensive review and analysis of multiple, publically available sources, which are not always fully consistent and complete. See e.g., California Energy Commission, Oil Supply Sources To California Refineries. Accessed May 8, 2016. http://www.energy.ca.gov/almanac/petroleum_data/statistics/crude_oil_receipts.html

> Source: California Energy Commission, aggregated from Petroleum Industry Information Reporting Act data. Please note that total of foreign oil receipts to refineries will not match that shown on other pages. The Petroleum Industry Information Reporting Act (PIIRA) data gives the breakdown by foreign, California and Alaska but not the foreign countries. The PIERS data includes the foreign breakdown by country but no domestic receipts. U.S. Dept. of Commerce, U.S. Dept. of Energy, Army Corps of Engineers, and State Lands Commission all give different totals by different breakdowns.

California Energy Commission, Foreign Sources of Crude Oil Imports to California 2015. Accessed May 8, 2016. http://www.energy.ca.gov/almanac/petroleum_data/statistics/2015_foreign_crude_sources.html

> Source: Energy Information Administration. Please note that total of foreign oil receipts to refineries may not exactly match that shown on other pages. The Petroleum Industry Information Reporting Act (PIIRA) data gives the breakdown by foreign, California and Alaska but not the foreign countries.

[14] Fielden, Sandy, RBN Energy, Slow Train Coming – Crude By Rail To Northwest Refineries Still Resilient, March 22, 2016. Accessed May 1, 2016. https://rbnenergy.com/slow-train-coming-crude-by-rail-to-northwest-refineries-still-resilient

only about 5% of WA supply, down from around 19% in 2011. **Foreign (non-Canadian) crude by tanker now provides about 30 kbpd of supply for WA.**

2.2 Alaska North Slope (ANS) Crude Production

Ongoing declines in ANS production will likely have only a small and gradual impact on crude supply for WA refineries. The VEDT is not needed to provide a substitute for ANS.

The VEDT is a very large facility, with a capacity to handle on average 360 kbpd of crude. Meanwhile, as discussed in Section 2.1, ANS now provides only about 250 kbpd supply to WA refineries. So even in the remote event that ANS ceased to provide any crude supply to WA, the VEDT would not be fully needed to provide substitute crude supply to WA.

A realistic analysis of the need for the VEDT to provide a substitute for ANS requires a detailed consideration of potential decline in ANS production and how this might affect crude supply to WA.

There is significant uncertainty regarding the future evolution of ANS production. While some decline is likely, production could also level off, both in the near-term and after 2020. Thus, ANS production might decline by about 10-20% by 2020, and then by another 10-20% by 2025.[15] In turn, ANS crude supply to WA could decline proportionally to the overall decline in ANS production (by about 10-20% by 2020, and then by another 10-20% by 2025).

Based on these scenarios, ANS supply to WA could be about 200-225 kbpd in 2020 (about 25-50 kbpd lower than current levels), and about 150-200 kbpd in 2025 (about 50-100 kbpd lower than current levels).

It should be recognized that only a portion of ANS production goes to WA refineries. Around half of ANS production goes to WA refineries, and most of remainder to CA refineries. A small portion of ANS goes to AK refineries.[16] Hence, only a portion of any

[15] The OCI Tracking Emissions Report, pp. 16-17; Fielden, Sandy, RBN Energy, Anchored Down in Anchorage – The ANS Crude Challenge, June 4, 2013. Accessed May 5, 2016. https://rbnenergy.com/anchored-down-in-anchorage-the-ans-crude-challenge http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1255r

[16] Four AK refineries are simple "topping" plants adjacent to the Trans-Alaska Pipeline System (TAPS). These refineries process ANS into lighter components (notably for use as transportation fuels) and inject the degraded bottoms back into TAPS; the resulting heavier ANS crude is then shipped via tanker to WA and CA. The Tesoro Kenai AK refinery is located on tidewater with a tanker port. This “cracking” refinery (footnote continued on next page)

decline in ANS production may affect supply to WA refineries. Decline in ANS production is unlikely to affect crude supply for AK refineries.[17]

The recent decline in ANS crude supply to WA may in part be demand-driven, rather than supply-driven. With the rapid growth in crude supply from CBR, WA refineries have shifted away from ANS, such that ANS can go to CA instead of WA. From 2011 onward, ANS crude supply to CA has leveled off at around 200 kbpd, while ANS supply to WA refineries has continued to decline.[18]

2.3 Crude by Rail (CBR)

CBR has grown very rapidly in WA. This rapid growth in CBR has been enabled by extensive development of energy logistics facilities in WA.

Four of the five WA refineries (including Tesoro) have recently constructed and are now operating onsite unit train unloading terminals, with a total capacity of 195 kbpd. The fifth WA refinery (Shell) is in permitting for a 61 kbpd unloading terminal.

(footnote continued from previous page)
processes ANS, AK Cook Inlet, and other crudes into a wider slate of refined products, some of which are shipped via tanker to markets outside AK (including heavy components used as feedstock at Tesoro Anacortes). In addition to the above refineries, a fifth simple topping plant (Flint Hills Northpole) began reducing throughput in 2010 and finally ceased all refining operations in 2014.
Econ One Research, The State of Alaska's Refining Industry, Prepared for the Alaska Department of Natural Resources, December 2015. Accessed May 1, 2016.
http://dog.dnr.alaska.gov/commercial/documents/alaskarefiningindustryreport.pdf
http://dog.dnr.alaska.gov/Publications/Documents/AnnualReports/2007_Annual_Report.pdf pp. 5-1-5-4
http://dog.dnr.alaska.gov/Publications/Documents/AnnualReports/2009_Annual_Report.pdf pp. 54-56
State of Washington Department of Ecology (2014), pp. 281-282.

[17] AK refineries have preferential access to ANS supply. The four topping plants are solely reliant on ANS crude supply and inject heated degraded bottoms back into TAPS, facilitating pipeline operations. The Tesoro Kenai refinery is configured to process lighter Cook Inlet, which is not optimally replaced by ANS. The VEDT might thus supply Bakken crude to the Tesoro Kenai refinery, but the volumes would be small (25 kbpd) and thus would be neither due to declining ANS production, nor meet a need in WA for substitute crude supply. See footnote 16 and OCI Tracking Emissions Report, pp. 20-21.

[18] See footnote 42.

Refinery Unloading Terminals[19]

Tesoro Anacortes	50 kbpd[20]
BP Cherry Point	70 kbpd[21]
Phillips 66 Ferndale	35 kbpd[22]
US Oil Tacoma	40 kbpd[23]
Shell Anacortes	61 kbpd[24]

[19] Some sources report substantially higher capacities than those assumed below. See e.g.,
https://fortress.wa.gov/ecy/publications/documents/1508010.pdf p.40
http://www.ecy.wa.gov/programs/spills/oilmovement/ChangingEnergyPictureChehalis.pdf

[20] Tesoro, "Tesoro Corporation Closes the Sale of the Anacortes Rail Unloading Facility to Tesoro Logistics," November 15, 2012,
http://phx.corporate-ir.net/phoenix.zhtml?c=242247&p=irol-newsArticle&ID=1759179.

[21] Whatcom County, Planning and Development Services, "SEPA Mitigated Determination of Nonsignificance (MDNS)" for BP West Coast Products, LLC, October 18, 2012,
http://www.whatcomcounty.us/DocumentCenter/View/4082;
John Stark, "BP taking next steps on rail project for crude oil," Bellingham Herald, November 30, 2012,
http://www.bellinghamherald.com/news/local/article22213488.html;
Samantha Wohlfeil, "BP Cherry Point oil train facility gets extra track," Bellingham Herald, June 9, 2015,
http://www.bellinghamherald.com/news/local/article23623255.html
https://www.youtube.com/watch?v=3pmKfJwtjpk.

[22] In sources below, unloading capacity is variously reported as 1 unit train every 2 days, offload stations for 54 cars, and 30 kbpd. Based on 1 unit train every 2 days or 54 cars per day, unloading capacity would be about 35 kbpd.
Whatcom County, Planning and Development Services, "SEPA Mitigated Determination of Nonsignificance (MDNS)" for Phillips 66 Company Ferndale Refinery, April 29, 2013,
http://www.co.whatcom.wa.us/DocumentCenter/View/4149
Phillips 66. "Refining: Ferndale Refinery,
http://www.phillips66.com/EN/about/our-businesses/refining/Pages/ferndale-refinery.aspx
"Phillips 66 Partners Announces Acquisition of Strategic Logistics Assets," October 22, 2014
http://unitholder.phillips66partners.com/newsroom/news-release-details/2014/Phillips-66-Partners-Announces-Acquisition-of-Strategic-Logistics-Assets/default.aspx
"Phillips 66 Partners LP: Form 10-K, year ending December 31, 2015," February 12, 2016,
http://d1lge852tjjqow.cloudfront.net/CIK-0001572910/b1b99a3c-38dd-49d4-8828-ec0a24e2bc3d.pdf

[23] Sources below report offload stations for 60 cars. Based on 60 cars per day, unloading capacity would be about 40 kbpd.
Sitts & Hill Engineers, Inc., "Crude Oil Railcar Facility - Tacoma, Washington,"
http://www.sitts-hill-engineers.com/crude-oil-railcar-facility/
Washington Department of Ecology, "Washington State 2014 Marine and Rail Oil Transportation Study," March 1, 2015, https://fortress.wa.gov/ecy/publications/publications/1508010.pdf p. 40.

[24] Sources below report unloading of 6 unit trains of 102 cars each per week or 612 cars per week. Based on 612 cars per week, unloading capacity would be about 61 kbpd.
Shell Oil Products Proposed Crude by Rail Unloading Facility, Washington State Department of Ecology Project Information, Shoreline Variance/ Substantial Development Permit
http://skagitcounty.net/Departments/PlanningAndPermit/shellpermit.htm
(footnote continued on next page)

As demonstrated by the experience in WA, refineries typically prefer to implement CBR via onsite unit train unloading terminals, rather via offsite facilities such as the VEDT. For refineries, onsite terminals enable greater control, ownership, and simpler logistics. By comparison, offsite facilities such as the VEDT involve third-party logistics and transloading to other another transport mode for final delivery.

Refineries (including in WA) sometimes use offsite transloading facilities, notably as an interim CBR strategy until they install an onsite unloading terminal. WA CBR to marine transloading facilities include one already in operation (Targa 40 kbpd), and two in permitting (71 kbpd). There have also been other proposed projects in WA, which like the VEDT would provide CBR to marine transloading, but there are now only two remaining active projects:[25] Westway in Grays Harbor (49 kbpd) and NuStar in Vancouver (22 kbpd).

Offsite CBR to Marine Transloading Terminals

Targa: 40 kbpd[26]

Westway: 49 kbpd[27]

NuStar: 22 kbpd[28]

(footnote continued from previous page)
Hearing Examiner Decision on SEPA Appeal, February 23, 2015, http://www.skagitcounty.net/PlanningAndPermit/Documents/ShellPermit/02-23-15%20Hearing%20Examiner%20Decision.pdf p. 3
Shell Anacortes Rail Unloading Facility Environmental Impact Statement (EIS) process: Scoping Report, December 18, 2015, https://shellraileis.blob.core.windows.net/media/Default/Library/ShellCBR_ScopingReport_Final.pdf pp. 4, 100
Conceptual Mitigation Plan, October 2015, https://shellraileis.blob.core.windows.net/media/Default/Library/ShellPSRConcepMitPlanWeb-1.pdf p. 1.

[25] The Imperium Grays Harbor and US Development Grays Harbor Rail Terminal projects are no longer planning on handling crude; the US Development Grays Harbor Rail Terminal project has terminated its option to lease agreement with Port of Grays Harbor.
Comments of REG Biofuels, LLC on Draft EIS for Terminal Expansion Project, November 30, 2015, http://www.standuptooil.org/wp-content/uploads/2016/01/REG-DEIS-Comment-letter.pdf;
Dameon Pesanti, "Company eyeing crude terminal at Grays Harbor quits lease," The Columbian, March 31, 2016, http://www.columbian.com/news/2016/mar/31/company-eyeing-crude-terminal-at-grays-harbor-quits-lease/

[26] City of Tacoma Planning and Development Services Department, "Notice of Land Use Decision" http://tacomapermits.org/wp-content/uploads/2013/06/40000203722D.pdf.

[27] City of Hoquiam and Washington State Department of Ecology, Westway Expansion Project Draft Environmental Impact Statement, August 2015 http://www.ecy.wa.gov/geographic/graysharbor/docs/wwVol1_Chapters_PublicDEIS_complete_web.pdf pp. 2-8, 6-14.

Future crude supply from CBR will be affected by actual buildout of proposed facilities, as well as how fully existing and proposed facilities are utilized.[29] Even without the VEDT, CBR could potentially provide up to an additional 120 kbpd of crude supply for WA refineries:

- 25 kbpd from fuller utilization of existing CBR facilities
- 45 kbpd from new refinery unloading facility (Shell Anacortes, if permitted)
- 50 kbpd from new marine transload facilities (Westway Grays Harbor and NuStar Vancouver, if permitted).

There have also been some development and proposals for CBR terminals in OR that would provide transloading to ships. But these facilities are small and/or not likely to be operating instead of the VEDT. Notably, the existing Global Partners terminal in Clatskanie/Port Westward, which was seeking to expand its crude handling, has now stopped handling crude and will only handle ethanol.[30]

(footnote continued from previous page)
[28] Unloading capacity is variously reported as 32 cars per day and 22 kbpd. Based on 32 cars per day, unloading capacity would be about 22 kbpd; however, some reports indicate facility might operate only 5 or 6 days per week, which would result in unloading capacity averaging 16-19 kbpd.
Southwest Clean Air Agency, "Air Discharge Permit ADP07-2710R3," April 21, 2014, http://www.swcleanair.org/permits/Final/07-2710R3TSD.PDF p. 17;
Stephanie Rice, "Vancouver council will not make NuStar decision," The Columbian, January 12, 2015, http://www.columbian.com/news/2015/jan/12/vancouver-council-will-not-make-nustar-decision;
Hearing Examiner Decision on SEPA Appeal, October 5, 2015, http://www.cityofvancouver.us/sites/default/files/fileattachments/community_and_economic_development/page/12901/prj-145874_nustar_appeal_decision.pdf pp. 10, 13.
[29] Average actual throughput at CBR facilities is typically less than design or peak capacity. Actual utilization can be as high as 75% (and sometime a bit higher), but can also be substantially lower, especially if economic factors are unfavorable for using CBR. CBR terminals do not always operate at full capacity, and many operate at relatively low utilization levels. But CBR refinery unloading terminals in the PNW seem to be operating at relatively high utilization rates and may continue to do so in the future. Also, unloading volumes may be lower for tar sands and other heavy crudes than for Bakken and other light crudes; with heavy crudes, volume per tank car is lower and unloading is slower. See OCI Tracking Emissions Report, pp. 9, 22, 23, 27-28; Fielden (2016), Slow Train Coming – Crude By Rail To Northwest Refineries Still Resilient.
[30] http://tdn.com/news/local/clatskanie-area-oil-terminal-shuts-down-laid-off/article_7d37f602-ef97-5daa-84a1-b29a1c4210ee.html
https://rbnenergy.com/slow-train-coming-crude-by-rail-to-northwest-refineries-still-resilient, see footnote 14.

3 California Refinery Market

3.1 Refineries, Logistics, and Oil Supply

CA refineries now have a combined capacity (2004 kbpd) and crude supply (1700 kbpd) that it is about 3 times that of WA refineries.

The mix of crude supply to CA refineries is now about:[31]

- 36% 615 kbpd CA crude production by pipeline[32]
- 12% 200 kbpd Alaska (ANS) by tanker
- 50% 850 kbpd overseas imports by tanker
- <2% 30 kbpd Canadian crude by pipeline and then by tanker or barge[33]
- <1% 5 kbpd US and Canadian crude by rail

The mix of crude supply to CA refineries has been similar since 2011.

CA is roughly self-sufficient in terms of refined products; almost all of the products consumed in CA are refined in CA, and almost all of the products refined in CA are consumed in CA.[34]

3.2 California Crude Production

The VEDT is not needed by WA to offset declining CA crude production. A decline in **CA** production refined in **CA** does not create a need in **WA** for substitute crude supply. But, a decline in CA production could provide a market in CA for crude from the VEDT. However, by itself this would be (at most) a relatively small market.

California crude production peaked in 1985 and by 2011 had declined by almost half.[35] Since then, CA production has leveled off at around 615 kbpd. Thus, while crude

[31] http://www.energy.ca.gov/almanac/petroleum_data/statistics/crude_oil_receipts.html
http://www.energy.ca.gov/almanac/petroleum_data/statistics/2015_foreign_crude_sources.html
[32] There are no crude pipelines into or out of CA. Crude moves from producers to refiners within CA mainly by pipeline, with some by rail and truck (for volumes, distances, and duration which are typically small).
[33] Crude from AB (notably tar sands dilbit) by Trans Mountain Mainline Pipeline to the Westridge Terminal in Burnaby BC and then by marine vessel to CA.
[34] See EIA (2015).

production has declined in both CA and AK, the decline in CA has been much smaller, more gradual, and has recently abated. Crude production in CA is now larger than in AK, and only two states (TX and ND) are bigger producers.

But while CA continues to be a large crude producer, it continues to be an even larger refiner and consumer of refined products. Since 2011, crude processed by CA refineries has remained steady at about 1700 kbpd.

As discussed in Section 3.1, all CA crude production is refined in CA to supply consumers in CA. Any decline in CA production will not affect crude supply to WA refineries, nor will it affect refined products supply to WA consumers. The VEDT is not needed to provide a substitute for CA crude production.

As discussed above, CA is roughly self-sufficient in terms of refined products; almost all of the products consumed in CA are refined in CA, and almost all of the products refined in CA are consumed in CA.[36] Hence, any decline in CA crude production will not affect supply of refined products to WA consumers.

There is significant uncertainty regarding the future evolution of CA production.[37] Since 2011, production has leveled off, and future production could remain at these levels, or possibly even rebound. But especially if crude prices remain lower for longer, CA production could begin to decline. In a decline scenario, CA crude production in 2020 could be about 80 kbpd lower than current levels, and in 2025 about 180 kbpd lower than current levels.[38]

On the other hand, the amount of crude refined in CA could also begin to decline. CA is undertaking extensive initiatives to enhance energy efficiency and reduce carbon and other air emissions. These initiatives reduce consumption of petroleum products and crude inputs to refining, as well as encourage a shift towards lower carbon intensity feedstocks. Especially over the longer term, less crude may be processed by CA refineries, and there may be a shift away from higher carbon intensity heavy crudes.

(footnote continued from previous page)
[35] California crude production is mainly on-shore (centered around Bakersfield in Kern County), but also includes sizeable offshore production (in State waters near shore and Federal OCS (Outer Continental Shelf)).
http://www.energy.ca.gov/2006publications/CEC-600-2006-006/CEC-600-2006-006.PDF
[36] See EIA (2015).
[37] Goodman, Ian and Brigid Rowan, Comments on Draft Environmental Impact Report (DEIR) Analysis of Oil and Gas Well Stimulation Treatments in California, March 16, 2015.
http://www.thegoodman.com/pdf/TGG20150316_NRDC_DEIRWellStimulation.pdf pp. 4-13
[38] The OCI Tracking Emissions Report, p. 20.

There is historical precedent for a major long-term decline in the amount of crude refined in CA. After peaking in 1989, crude processed by CA refineries declined by about 15% before leveling off from 2011 onward. Since 1989, the reduction in crude refined (250 kbpd) has nearly offset the decline in CA crude production (315 kbpd).

If a similar decline in refining occurs in the future, this could offset any decline in CA crude production. Thus, there is significant uncertainty regarding how much, if any, market there will be in CA for crude from the VEDT as a substitute for CA crude production.

CA production includes a wide range of heavy, medium, and light crudes. But most CA production is heavy, and the remainder mostly medium. Thus, any decline in CA production would be mostly heavy crude, and perhaps some medium.

Moreover, while CA refineries can and do process a wide range of crudes, there is very large capability to process heavy crudes.[39] Thus, any replacement crude supply for CA via the VEDT could include both heavy tar sands and light Bakken.

3.3 Alaska North Slope (ANS) Crude Production

Any decline in ANS production going to CA will not create a need in WA for substitute crude supply; however, it could provide a market in CA for crude from the VEDT. But by itself, this would be a very small market.

Depending on the future evolution of ANS production and the portion going to CA, ANS crude supply for CA refineries could decline in the future. There is significant uncertainty regarding the future evolution of ANS production. While some decline is likely, production could also level off, both in the near-term and after 2020.

Thus, ANS production might decline by about 10-20% by 2020, and then by another 10-20% by 2025.[40] In turn, ANS crude supply to CA could decline proportionally to the

[39] Most CA refineries have cokers, used to upgrade heavy (bottom of the barrel) components into lighter, more valuable products (notably transportation fuels). Some CA refineries produce substantial amounts of heavy products (heavy fuel oil, notably for ships, but also for export, and asphalt). Hence, CA refineries can process crudes with sizable heavy components (traditionally CA crudes and ANS, but also tar sands heavy crudes and ANS look-alikes (notably tar sands dilbit blended with Bakken).
Goodman, Ian and Brigid Rowan, Comments on Initial Study/Mitigated Negative Declaration (IS/MND) Valero Crude by Rail Project, July 1, 2013.
http://www.thegoodman.com/pdf/TGG20130701_NRDC_BeniciaValeroCBR.pdf pp. 10-11, 18-21
http://www.eia.gov/todayinenergy/detail.cfm?id=26132
https://www.nrdc.org/sites/default/files/ene_15042701a.pdf

other decline in ANS production (by about 10-20% by 2020, and then by another 10-20% by 2025).

Based on these scenarios, ANS supply to CA could be about 160-180 kbpd in 2020 (about 20-40 kbpd lower than current levels), and about 120-140 kbpd in 2025 (about 40-80 kbpd lower than current levels).

It should be recognized that only a portion of ANS production goes to CA refineries. Around half of ANS production goes to WA refineries,[41] and most of remainder to CA refineries.[42] A small portion of ANS goes to AK refineries.[43] Hence, only a portion of any decline in ANS production may affect supply to CA.

The recent decline in ANS production has affected crude supply to WA, but has not had the same impact on CA. From 2011 onward, ANS crude supply to CA has leveled off at around 200 kbpd, while ANS supply to WA refineries has continued to decline.[44] With the rapid growth in crude supply from CBR, WA refineries have shifted away from ANS, such that ANS can go to CA instead of WA.

CA refineries that process ANS can and do process a range of crudes, including heavy crudes, as well as medium and light crudes. Replacement crude supply for ANS via the VEDT could include both heavy tar sands and light Bakken.[45]

3.4 Overseas Imports

As discussed in Section 3.1, the supply mix in CA has been stable since 2011, with overseas imports providing half of crude supply to CA refineries, about 850 kbpd.

In contrast to overseas imports into WA refineries, which are very small (currently about 30 kbpd), overseas imports into CA refineries are very sizable (about 850 kbpd). As discussed in Sections 3.2 and 3.3, supply to CA could decline from crude production in AK and CA, but these declines may be small and offset by declines in the amount of

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(footnote continued from previous page)
[40] The OCI Tracking Emissions Report, pp. 16-17; Fielden, Sandy, RBN Energy, Anchored Down in Anchorage – The ANS Crude Challenge, June 4, 2013. Accessed May 5, 2016. https://rbnenergy.com/anchored-down-in-anchorage-the-ans-crude-challenge http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1255r
[41] ANS supply to WA refineries is discussed in a Technical Appendix (Section 2.2).
[42] http://www.energy.ca.gov/almanac/petroleum_data/statistics/crude_oil_receipts.html
[43] See footnotes 16 and 17 .
[44] See footnote 42.
[45] See footnotes 11 and 39.

crude refined in CA. Thus, overseas imports into CA may remain stable at around 850 kbpd, unless there is a big increase in alternative crude supplies and/or a big drop in crude refined.

Hence, to the extent there is a market to replace overseas imports into CA, this is potentially a very large market. The VEDT (with a capacity to handle 360 kbpd of crude) is designed to supply large markets. And in fact, CA is the only US market that could feasibly utilize the large amount of crude that could be handled by the VEDT.

But regardless of whether there is actually a market in CA for crude from the VEDT, this does not create a need in WA for the VEDT to supply energy to WA. Instead, this is a potential commercial opportunity for the VEDT to supply the energy needs of a jurisdiction outside WA.

In various ways, the large VEDT facility and large CA refinery markets may be well matched. The VEDT needs large markets that can utilize the large amount of crude that can be handled by this facility. Meanwhile, California refineries need large suppliers that can consistently and reliably provide the large amount of crude being imported into CA. Moreover, there can be various economies of scale and synergies between large suppliers and large customers.

Nonetheless, there is significant uncertainty regarding the CA market for crude from the VEDT. Refining is a highly competitive global industry. CA refineries have good access to crude by tanker from global markets, and these refineries import overseas crudes when it is profitable to do so.

Global crude markets are intensely competitive. The world is currently awash in low-priced crude, and crude prices are expected to remain low for the short- to medium-term. Refineries will continue to adjust their crude supply in response to evolving market conditions. They will buy and process the crudes that provide the highest margins.[46]

[46] Crude selection affects refinery economics and profitability in numerous ways. Each refinery is uniquely configured to process a set of raw materials (crude slate) into a desired set of products (product slate). Moreover, each type of crude is also unique. Crude is the single largest input and cost for refiners. Different crudes can have widely varying costs ($/bbl). Crudes differ in terms of product slate, and thus the overall revenues from product sales. Crudes also differ in terms of processing; some crudes are more difficult and more costly to refine. Moreover, the factors affecting refinery economics and profitability (notably pricing for crudes and products) are uncertain and continually evolving. Refinery configuration is key in determining the suitability of crudes for a given refinery. Crude selection is based on the relative economics of available choices, typically assisted by analysis using Linear Programming (LP) models. These complex LP models incorporate representations of each refinery unit's operations, every potential feedstock and product, and take into account varying properties and pricing.
(footnote continued on next page)

Overseas imports are now highly competitive with other crude sources. Especially in a low price environment, logistics can be an important competitive factor.

Overseas imports are especially competitive in markets where they are logistically advantaged relative to alternative crude supplies, notably due to the following factors:

- high quality access to crude by tanker (and thus relatively low logistics cost for overseas imports), and/or
- lower quality access to alternative crude supplies (and thus relatively high logistics and other costs for alternative crude supplies).

CA refineries are typically in coastal areas with good access to crude by tanker from global markets.[47] But CA refineries have only limited access to alternative crude supplies. CA has limited existing energy logistics facilities that would enable lower logistics costs and access to a wide range of crude types.

California's heavy reliance on overseas imports reflects in part that the existing CA logistics used for crude by tanker could be repurposed from handling ANS to handling overseas imports. Even more so than for WA refineries (which are located on Puget Sound), CA refineries are virtually all in coastal locations proximate to the open ocean. Thus, marine infrastructure for the CA refineries was typically already in place, such that overseas imports require "relatively" little infrastructure and intrusion in CA.

As a result, overseas imports have remained a very large portion of crude supply for CA refineries, and these imports are likely to remain at very high levels, especially with overseas imports being very competitively priced.

A detailed analysis of the overseas imports into CA concludes that the potential market for crude handled by the VEDT could include both heavy tar sands and light Bakken. In particular, the crude handled could include a sizable proportion of dilbit, including dilbit

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(footnote continued from previous page)
Goodman and Brigid Rowan (2013), Comments on Initial Study/Mitigated Negative Declaration (IS/MND) Valero Crude by Rail Project, pp. 4-7;
http://www.nrcan.gc.ca/energy/crude-petroleum/4561
ICCT, An Introduction to Petroleum Refining and the Production of Ultra Low Sulfur Gasoline and Diesel Fuel, October 24, 2011. Accessed May 9, 2016.
http://www.theicct.org/sites/default/files/publications/ICCT05_Refining_Tutorial_FINAL_R1.pdf

[47] Compared with CA refineries, some other refineries (both within and outside the US) have even better access to global crudes. These logistically advantaged refineries have lower shipping times and costs, notably due to location (proximity to crude production and open ocean) and port facilities (capability to efficiently offload larger tankers). But shipping costs by crude tankers are generally quite low (in the order of $1.50-$3.50/bbl). Thus, there may be only small differences in shipping costs between refineries (and especially between CA refineries and those elsewhere with even better access to global crudes).

blended with Bakken into ANS look-alikes; the VEDT is designed to facilitate crude blending.

In terms of crude types, the overseas imports into CA are mainly medium crudes, with some heavy, and only a small share of light:

- 35% 300 kbpd Heavy (API gravity ≤ 27°)
- 55% 465 kbpd Medium (API gravity >27°< 35°)
- 10% 85 kbpd Light (API gravity ≥ 35°)

The mix of crude types for overseas imports into CA reflects the history and distinctive nature of CA refinery crude supply. As discussed in Sections 3.2 and 3.3, CA refineries can and do process a wide range of crudes, but there is very large capability to process heavy crudes. Historically, much of CA refinery crude supply was from CA production and ANS, both of which have a sizable proportion of heavy (bottom of the barrel) components. As crude supply from CA production and ANS has declined, this supply has been replaced by overseas imports, which also have a sizable proportion of heavy components.

But as also discussed in Sections 3.2 and 3.3, the crude supply that has declined and been replaced by imports is mainly from ANS; the decline in supply from CA production has been much smaller, more gradual, and has recently abated. Thus, the overseas imports into CA are overall somewhat similar to ANS.

These imports come from a variety of global sources, but the supply mix is dominated by a few large crude producer countries and regions:[48]

- 36% 310 kbpd Saudi Arabia
- 15% 125 kbpd Other Middle East/Persian Gulf (Iraq, Kuwait)
- 40% 340 kbpd Latin America (Ecuador, Columbia, Brazil, Venezuela)[49]
- 5% 40 kbpd Angola
- 4% 35 kbpd Russia and Others

In particular, Saudi Arabia supplies more than a third of the overseas imports into CA refineries. Together with supply from Iraq and Kuwait, half of the overseas imports into CA come from Persian Gulf producers. Most of the remainder (about 40% comes from Latin American producers.

[48] Based on EIA data for 2015 and other recent years. See footnote 31 and OCI Tracking Emissions Report, p. 19.
[49] In some recent years, Latin America sources also include Mexico and Peru.

There are important differences between the crude types provided by various sources of overseas imports.[50] The imports into CA from Persian Gulf producers are mainly medium crudes, together with some light crudes. Meanwhile, the imports from Latin America are mainly heavy crudes, with some medium.

As explained below, the overseas imports from Persian Gulf producers may be less likely to be displaced by crude supply from the VEDT. Thus, the crudes handled by the VEDT may be replacing supply from Latin America that is mainly heavy crudes.

Persian Gulf producers (notably Saudi Arabia) may be in a strong competitive position to maintain their historically large share of CA refinery market. Persian Gulf producers are very large, long-term suppliers to global crude markets. They have huge crude reserves, very low production costs, and well-established, relatively low cost logistics providing high quality access to a wide range of global markets (including California).[51]

In various ways, the large Persian Gulf producers and large CA refinery markets are well matched. Large Persian Gulf producers need large markets that can utilize the large amount of crude from these producers. Meanwhile, California refineries need large suppliers that can consistently and reliably provide the large amount of crude being imported into CA. Moreover, there can be various economies of scale and synergies between large producers and large customers.

Persian Gulf producers may be well positioned to continue supplying CA markets. Hence, to the extent that overseas imports into CA may be offset by alternative crude supplies, the suppliers more likely to be displaced may be those outside the Persian Gulf. This suggests that crude supply from the VEDT may be more likely to displace overseas imports from Latin American producers, which are mainly heavy crudes, with some medium.

That said, especially in the context of intensely competitive global crude markets, Latin crude producers selling into the CA refinery market may also be difficult to displace. Markets for heavy crude are limited to refineries that are configured for these crudes, which are difficult and more costly to refine. CA is a large heavy crude market, which is relatively proximate and accessible for Latin American producers. Thus, Latin American producers may be well positioned to continue supplying CA markets.

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[50] Based on EIA data for 2015 and other recent years. See also OCI Tracking Emissions Report, p. 19. NB: In Table 4.2 of OCI Report, the following headings are transposed: Medium and Light; Latin America and Middle East.

[51] Compared with Saudi Arabia and Kuwait, Iraq has not been as consistently well positioned as a supplier to global crude markets. Nonetheless, Iraqi is a large, long-term supplier to CA, with a market share typically around 20% (but sometimes considerably higher or lower).

Notably, compared with crude supply via the VEDT, Persian Gulf and Latin American producers have overall higher quality access to CA refinery markets (and thus relatively low logistics cost). Crude producers in the Persian Gulf and Latin America access the CA market via large tankers that provide low logistics cost even over long distances (including from the Persian Gulf). Meanwhile, for crude supply via the VEDT, North American crude producers (notably in ND and AB) would access the CA market via CBR to WA and tanker or barge to CA. CBR is a relatively high cost transport mode, as is shipping between US ports on Jones Act vessels.[52]

Thus, it is somewhat unclear how competitive the VEDT will be to displace overseas imports. As discussed in Section 3.5, CBR is not now and has never been a significant part of crude supply for CA refineries.

In response to potential crude supply from the VEDT, which could displace overseas imports, overseas crude producers (which are in many cases state-owned) have mechanisms available to avoid being displaced from the CA market. As necessary, crude producers can provide price discounts and other inducements to CA refiners. This might be beneficial for CA refiners, and especially for Tesoro (the largest CA refiner), but it is unclear to what extent (if any) this would benefit WA. Moreover, given the dynamics in the relevant markets, crude price discounts (especially if selectively applied) will not affect pricing for refined products. In other words, CA refiners will benefit from lower crude prices, but consumers (in CA and especially in WA) will not.

The above analysis suggests that the VEDT could be used by Tesoro to reduce its crude supply costs, and the VEDT might have benefits for Tesoro in a variety of scenarios. The VEDT could be used to shift crude markets in ways specifically favorable for Tesoro. And while Tesoro has indicated that the VEDT will be available for use by third-party customers as well as Tesoro, the VEDT may largely benefit Tesoro (as opposed to other CA refiners, or anyone other than Tesoro).

One factor distinguishing Tesoro from other refiners is that Tesoro (via a network of subsidiaries and joint ventures) has (via ownership/acquisitions/leases/other agreements) very extensive energy logistics facilities all the way from crude production areas (that could supply the VEDT) to refinery destination markets, including the following:

[52] For discussion of the Jones Act, see footnote 64.

- crude gathering
- CBR unit train loading terminals
- CBR tank cars
- CA refinery market logistics (especially in Los Angeles due to acquisition of BP Carson refinery and related logistics, but also in Bay Area)
    - Marine terminals
    - Pipelines
    - Crude storage.

3.5 Crude by Rail (CBR)

CBR is not now and has never been a significant part of crude source for CA refineries. CBR into CA peaked at around 1% of total CA crude supply in 2013 and 2014, dropped to 0.3% in 2015, and in recent months has been averaging only 3 kbpd.[53] The small remaining CBR into CA is from NM (Permian), UT (Uinta Waxy), and WY (Niobrara light shale and possibly some Canadian).[54] Previously, there was some CBR into CA from ND (Bakken), CO (Niobrara light shale), and Canada (AB, notably tar sands dilbit).

Since the beginning of the CBR boom, there have been a number of proposals in CA for CBR unloading terminals designed to handle larger unit train shipments. However to date, only one terminal was permitted and built: a Plains All American terminal went online in December 2014 in Taft (near Bakersfield) for unloading from rail to pipeline.[55]

Other proposals have been either turned down, under appeal, or put on hold. TGG has had extensive involvement in the permitting processes for California CBR projects.[56]

Several key factors explain why CBR is so limited in CA, and why CA has been so limited and restricted in developing CBR:

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[53] http://www.energyarchive.ca.gov/petroleum/statistics/crude_by_rail/2012_crude_by_rail.html
http://www.energy.ca.gov/almanac/petroleum_data/statistics/2013_crude_by_rail.html
http://www.energy.ca.gov/almanac/petroleum_data/statistics/2014_crude_by_rail.html
http://www.energy.ca.gov/almanac/petroleum_data/statistics/2015_crude_by_rail.html
http://www.energy.ca.gov/almanac/petroleum_data/statistics/2016_crude_by_rail.html
See also footnote 55.

[54] Crude from AB (notably tar sands dilbit) by Express Pipeline to Casper, WY and then by rail to CA). https://usdg.com/terminal/casper/

[55] Fielden, Sandy, RBN Energy, Slow Train Coming – Crude By Rail Shipments To California Drying Up, March 29, 2016. Accessed May 1, 2016. https://rbnenergy.com/slow-train-coming-crude-by-rail-shipments-to-california-drying-up Table #2.

[56] Goodman and Brigid Rowan (2013), Comments on Initial Study/Mitigated Negative Declaration (IS/MND) Valero Crude by Rail Project, TGG has also provided technical assistance on multiple sets of Comments by Phyllis Fox regarding both the Valero Benicia and Phillips 66 Santa Maria projects.

- California has very extensive and restrictive regulations regarding environmental quality and project permitting, in part due to the state's severe air quality problems.

- The regulatory processes are complex and allows for significant public input.

- There is significant public opposition to CBR in California.

- California has a very large population and areas of high population density, with substantial proximity to refineries, proposed CBR facilities, and the rail network relating to CBR.

- California refineries are concentrated in coastal areas, facilitating access to crude supply (by water and in some cases local production) and retail markets; CBR to these refineries entails extensive routings throughout California with high proximity to people, water and economic activity.

The combination of these key factors has resulted in significant delays and rejections for proposed CBR projects. Resistance to building unloading terminals delayed refiners' plans such that shipments never really took off. Unlike WA, CA was not part of the CBR boom; hence, in the ensuing bust, CA refineries do not now have large sunk costs encouraging continued use of CBR. So in the face of currently unfavorable economics, CA refineries have cut back their already minimal use of CBR.

3.5.1 CA Crude by Rail (CBR) Facilities

CA has no recently constructed onsite crude by rail unit train unloading terminals, and 93 kbpd of proposed terminals.

Proposed Refinery Unloading Terminals

Valero Benicia	70 kbpd
Phillips 66 Santa Maria	23 kbpd

Permitting for the Valero Benicia project was denied on February 11, 2016, and is currently under appeal.[57]

Permitting for the Phillips 66 Santa Maria project (5 unit trains per week/38k bpd) was recommended by Staff for denial; Phillip 66 then proposed that the project be downsized (3 unit trains per week/23k bpd); issuance of a decision has been deferred until May 15, 2016 at the earliest.[58]

There was also a project to develop a 140 kbpd CBR unloading terminal at the Alon Bakersfield refinery. This refinery is now shut down, but could have been modernized and restarted as part of the project. The CBR terminal could have been used to supply the refinery, but also to supply other CA refineries.[59] This project was approved by Kern County in September 2014, but Alon has since put the project on hold. Alon has stated that the CBR project is not justified given current crude pricing.

CA also has 70 kbpd of recently constructed offsite rail to pipeline transload terminals, and 16 kbpd of legacy ethanol offsite rail to truck unit trains terminals that can also handle crude.

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[57] ESA, Valero Benicia Crude By Rail Project Final Environmental Impact Report, prepared for City of Benicia, January 2016, http://www.ci.benicia.ca.us/vertical/sites/%7BF991A639-AAED-4E1A-9735-86EA195E2C8D%7D/uploads/Final_EIR-Chapters_1-2.pdf p. 1-2;
City of Benicia, Planning, Valero Crude by Rail http://www.ci.benicia.ca.us/index.asp?SEC=B7EDC93A-FFF0-4A14-9B1A-1C8563BC256A.

[58] MRS (Marine Research Specialists), Phillips 66 Company Rail Spur Extension And Crude Unloading Project Final Environmental Impact Report, prepared for San Luis Obispo County, December 2015, http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/FEIR+Phillips+Rail+Spur+Project+Dec+2015/Main+Document+EIR/Phillips+Rail+Spur+Project+FEIR+December+2015.pdf p. 1-4;
Phillips 66 Final County Staff PowerPoint, February 4, 2016, http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Planning+Commission+Hearings/February+25$!2c+2016/County+Staff+Powerpoint+Feb+25+2016.pptx;
Phillips 66 Applicant Planning Commission Presentation, February 4, 2016, http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Planning+Commission+Hearings/February+4$!2c+2016/Presentations+February+4$!2c+2016/Phillips+66+Applicant+Planning+Commission+Presentation.pdf;
April Charlton, "No decision made on Phillips 66 rail spur," Santa Maria Times, April 15, 2016, http://santamariatimes.com/news/local/no-decision-made-on-phillips-rail-spur/article_340b9cb3-faa3-57e6-a817-09cc41ac0e52.html.

[59] Alon Bakersfield is pipeline connected, and could have sent crude to refineries in both the Los Angeles area and Bay area.

Offsite CBR Transloading Terminals

Plains Bakersfield 70 kbpd[60]

Kinder Morgan Richmond: 16 kbpd[61]

There have been various proposals for developing more offsite CBR facilities in CA, but all have been put on hold or cancelled.

[60] This transload facility located in Taft, CA transfers crude into the Plains pipeline system (providing access to Los Angeles area refineries), which interconnects with other crude pipelines (providing access to Bay Area refineries).

[61] This legacy ethanol transload facility is now permitted to also handle crude. This facility can handle unit trains, but the transloading process is relatively slow, using 4 mobile pumps to directly transfer from tank car to truck. The air permit limits annual throughput to 240,000,000 gallons of crude and ethanol, equivalent to 15.65 kbpd. This facility has been used to supply the Tesoro Martinez refinery via truck with 3 unit trains per month of Bakken crude.
Q3 2013 Tesoro Corporation Earnings Conference Call, November 7, 2013, pp. 1, 4, 12, 18.
http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9NTI0NzA0fENoaWxkSUQ9MjEwNjc1fFR5cGU9MQ==&t=1

4 Comparison of Washington and California Refining and CBR

Refining Capacity:	WA 657 kbpd, vs. CA 2004 kbpd	(WA=33% CA)
Crude Supply:	WA 560k bpd, vs. CA 1700 kbpd	(WA=33% CA)

Onsite refinery unit train unloading terminals

Existing	WA: 195k bpd, vs. CA 0 kbpd
In Permitting/Appeal	WA: 61kbpd, vs. CA 93kbpd

Offsite unit train unloading terminals

Existing	WA: 40 kbpd, vs. CA 86 kbpd
VEDT in permitting	WA: 360 kbpd
Other in Permitting	WA: 71k bpd, vs. CA 0 kbpd

CA has about 3 times as much refining as does WA. But compared with WA, CA also a much larger population and oil consumption. CA has a population of 39 million, which is about 5.5 times the population of WA (7 million)). Hence relative to population, WA has almost most twice as much refining as does CA.

WA also has dramatically more CBR than CA, in both absolute and relative terms. Four of five WA refineries have recently constructed onsite crude by rail unit train unloading terminals, with a total capacity of 195k bpd. The fifth refinery (Shell Anacortes) has a 61k bpd onsite terminal in permitting. WA is also the proposed site of the VEDT, a 360k bpd CBR transload to marine terminal in permitting. If the VEDT and Shell Anacortes projects go forward, WA would have a total of 656k bpd of CBR terminals, similar in amount to the total in-state refining capacity.

Meanwhile, CA has no recently constructed onsite crude by rail unit train unloading terminal. Proposed projects at two refineries have been substantially delayed by permitting issues.

5 VEDT Crude Supply and Destination Markets

Crude produced outside WA (most likely from Canadian tar sands and Bakken) can be economically shipped through WA and on to refineries outside WA (in CA and Asia). Federal restrictions on US crude exports have recently been removed, facilitating exports of both Bakken and tar sands crudes from the US.[62] The VEDT has extensive storage, blending, and port facilities, enabling both

- larger tankers (up to 160,000 to 165,000 MDWT), which can be used to economically ship crude longer distances (notably to Asia, and possibly to CA refineries), and

- smaller tankers and barges, which can be used for shipping crude shorter distances (to CA and possibly to WA refineries).[63]

A reasonable case can be made that some or possibly all the crude from the VEDT will go to California, but a reasonable case can also be made that some or possibly all the crude from the VEDT will go to Asia.[64]

There are large potential markets for both Canadian tar sands crudes and Bakken in CA, notably to offset overseas imports. And numerous reports have concluded there are large markets for both tar sands crudes and Bakken in both CA and Asia.[65]

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[62] Restrictions on US crude exports affected overseas exports of tar sands crudes owing to a) tar sands crudes often containing US sourced diluents, which could be classified as US crude, and b) restrictions on commingling with US crudes in transit and storage.

[63] Refinery markets in WA and CA are relatively nearby and also have various restrictions limiting size of tankers and cargoes. Shipping distances are about 300-350 nautical miles to WA refineries, 650 nautical miles to Bay Area refineries, and 950-1000 nautical miles to Los Angeles area refineries. The OCI Tracking Emissions Report (p. 46) assumes barges will be used for shipping crude to WA and CA (Bay Area) refineries. Tankers could also be used for shipping crude to CA, and especially to Los Angeles area refineries (which are longer distance from the VEDT and have less restricted port access, notably at Tesoro facilities which were acquired from BP).

[64] Shipping costs are one factor affecting markets for crude from the VEDT and specifically whether crude goes to Asia or CA. Asia is much further than CA, but shipping costs may be similar, in part due to the Jones Act. As a port facility located in the US, the VEDT is subject to the Jones Act of 1920, which requires that any cargo shipped between two U.S. ports must be carried on vessels built in the United States, crewed by U.S. citizens and at least 75% owned by U.S. citizens. Shipping rates on Jones Act compliant vessels are significantly higher than on foreign vessels. Shipments from the VEDT to US ports (including WA, CA, AK, HI) would be via higher cost Jones Act vessels, while shipments to foreign ports (notably in Asia) would be via lower cost foreign vessels.

[65] OCI Tracking Emissions Report, especially pp. 22, 25-28, 46-47 with netback analysis for Canadian tar sands and US Bakken to both CA and China via CBR to the Pacific Northwest and then via barge to CA (footnote continued on next page)

TSPT's 2014 Application[66] focused on the transportation of Bakken crude to and through the VEDT to US West Coast (PADD 5) refinery markets; but since then, North American crude markets have evolved dramatically in the following ways, which are quite divergent for Bakken and Tar Sands:

- The crash in crude prices has resulted in much less investment (less drilling and fracking) in the Bakken Formation, such that production has peaked and started to decline.

- CBR is a relatively high cost transport mode; with the crash in crude prices, falling production, and ongoing buildout of pipelines, CBR is now much less economically attractive for Bakken, and CBR volumes are declining.

- Bakken is a relatively shorter distance to WA by rail than to other coastal refinery markets;[67] CBR to WA is cheaper than CBR to other markets. WA CBR volumes have remained relatively high.[68]

- Canadian tar sands are increasing as a potential crude input for the VEDT. Compared with Bakken, tar sands production and expansion cannot be rapidly adjusted in response to lower crude prices. Thus, tar sands production is likely to increase over the next few years, even if crude prices remain lower for longer.[69]

- Pipelines are by far the preferred option of the industry for crude transport (especially for tar sands), because pipelines have relatively low costs and high capacity.

(footnote continued from previous page)
or tanker to China. This report assumes barge to CA (Bay Area) refineries, but tankers may also be an option to CA refineries, especially in the Los Angeles area where Tesoro has extensive facilities. The OCI Tracking Emissions Report assumes Panamax tanker (70k MDWT) to China, but the VEDT can load larger tankers (up to 165 MDWT) that enable lower cost long distance shipping to China. Hence, the OCI netback analysis may understate the economic case for shipments to California and Asia from the VEDT.

[66] TSPT's Application was originally submitted in August 2013, and then amended in January 2014. See also Corpron, David and Irina Makarow, TSPT Response to EFSEC Request for Additional Information to Assess EIS Alternatives, February 5, 2015.

[67] The rail network to WA is also less congested than rail to other refinery markets, especially if via Chicago to US East Coast.

[68] WA refiners have made sizable commitments to CBR (notably for terminals and tank car leases), so some CBR costs are now "sunk." Fielden (2016), Slow Train Coming – Crude By Rail To Northwest Refineries Still Resilient.

[69] See footnote 70.

- Tar sands pipeline capacity is highly constrained, such that there could be widespread use of CBR, despite its relatively high cost.[70]

- The remote and pipeline-constrained Canadian tar sands are a relatively shorter distance to WA by rail than to other points of access to tidewater (outside BC); CBR to WA is cheaper than CBR to other markets. Therefore, in the absence of pipeline alternatives, CBR to WA is a viable substitute for pipelines for crude producers.

Therefore, if Canadian tar sands remain pipeline-constrained, the VEDT could become key transportation logistics for Canadian tar sands; and CA and/or Asia could become key destinations for this crude. Access to Asian markets is valuable for tar sands producers both

- in terms of increasing options/diversification; and
- because these markets may have less stringent environmental restrictions/social licence concerns.

It is notable that CBR could become key transportation logistics for tar sands. As TGG has emphasized in other expert reports on crude oil logistics, "pipelines are by far the preferred option of the industry for crude transport (especially for tar sands), because pipelines have relatively low costs and high capacity."[71] TGG's KXL DSEIS Market Analysis Report (2013) (pp. 45-50) contains a longer analysis of why pipelines are preferred to rail. In this report, TGG accurately predicted that attempts to use rail instead of pipeline would lead to problems and resistance.

According to RBN Energy:[72]

> [T]he rapid demise of CBR movements [...] is testament to the weaknesses of this method of crude transport. The most significant of those weaknesses is the higher freight cost. Pipelines cost a lot more to build but once up and running

[70] Enbridge, Investment Community Presentation, April 2016. Accessed May 10, 2016. http://www.enbridge.com/~/media/Rebrand/Documents/Investor%20Relations/2016/Investment%20Community%20Presentation.pdf see especially p. 6 (emphasis removed):

> Mainline at full capacity:
> Record 2.6 mmbpd throughput in January
> ~800 kbpd oil sands supply growth through 2019 [footnote in original omitted]
> WCSB short >500 kbpd pipeline capacity through 2021

[71] TGG Quebec Report, p. 10

[72] Fielden, Sandy, RBN Energy, Slow Train Coming – Victory Of American Ingenuity Over Crude Pipeline Delays And Congestion, April 24, 2016. Accessed May 1, 2016. https://rbnenergy.com/slow-train-coming-crude-by-rail-to-northwest-refineries-still-resilient

they are a far cheaper way to ship crude. And as we have noted – once pipeline alternatives exist there is an inevitable shift of traffic away from rail and to the pipes.

But while trend is generally away from CBR, the dynamics are different for tar sands where there may be shift towards CBR.

Meanwhile, Bakken production and CBR are declining. But especially if crude prices rebound, Bakken production could rebound, perhaps quite rapidly. US refinery markets for light Bakken crude are limited. So in a scenario where Bakken (and other shale production) is growing, there could be a market for Bakken crude exports via WA.

In summary, there are markets in both California and Asia for Bakken and Canadian tar sands crudes, and it could be commercially attractive for these crudes to be shipped by rail through the VEDT and then by tanker to Asia or by tanker or barge to CA. Some or possibly all the crude from the VEDT could be shipped to CA, but some or possibly all could go to Asia.

5.1 VEDT Lease Amendment (April 2016)

On April 22, 2016, TSPT agreed to amendments to the lease between TSPT and the Port of Vancouver, pertaining to the site where the VEDT is hosted. Specifically, the relevant amendments to the lease relevant to crude types and foreign exports are as follows:

a. "Marine Terminal Area: (i) Loading and unloading of vessels with Petroleum Products delivered to the Premises, which Petroleum Products are to be delivered to domestic ports (to the extent such domestic restriction is permissible under all applicable law);"
b. The definition of Petroleum Products is restricted to pipeline grade hydrocarbons.[73]

First, the VEDT is designed to handle a wide range of pipeline-grade crude types. The VEDT is not designed to handle raw bitumen and other ultra-heavy crudes.[74] Therefore,

[73] Amendment to Ground Lease between Port of Vancouver and Tesoro Savage Petroleum Terminal LLC, Notarized April 22, 2016, p. 5.
[74] TSPT, Response to the Energy Facility Site Evaluation Council's (EFSEC) Draft EIS Data Request 2, dated 30 January 2015, February 25, 2015, p. 23.

the lease amendment regarding the restriction to pipeline grade hydrocarbons at the VEDT has no impact on the types of crudes that could be handled by the VEDT. Even absent this restriction, all the crudes coming into the VEDT by unit train (Bakken (mainly light shale oil crude) and Canadian tar sands (mainly dilbit) would be pipeline grade. In fact, for shipment to Asia in large tankers, pipeline quality dilbit would be more suitable. Therefore the restriction to pipeline grade crude would have no effect on the economic viability of out-of-state or foreign exports for the VEDT.

Second, it is otherwise uncertain to what extent the restriction to deliver to domestic ports will be in place over the operating life of the VEDT. TSPT and the Port of Vancouver have just agreed to amend the lease. They could in the future agree to further modify the lease, including removing the restriction to deliver to domestic ports. At this time, TSPT is seeking required approvals to proceed with building the VEDT. TSPT, and perhaps Port of Vancouver as well, are thus highly motivated to do what is needed to get the VEDT built.

But once the VEDT is built and operating, this will shape the context for potential modifications to the lease. Once energy facilities are operational, there is typically strong support for doing what is needed, so that facilities can continue to operate and be commercially viable. If TSPT views the restriction to deliver to domestic ports to be commercially inconvenient, it could (and likely would) seek to test the enforceability of this restriction and if need be seek to have this restriction removed from the lease. In particular, TSPT claims that the VEDT will provide economic benefits to host communities. If TSPT finds the restriction on exports to be commercial inconvenient, it could (and likely would) advocate for removing this restriction so that the VEDT can be commercially viable and provide benefits to host communities.

Given this uncertainty regarding duration of the domestic port restriction, this Technical Analysis considers the economic viability of crude exports to both domestic, as well as foreign ports.