Can Rail Handle Canadian Crude?

Growing demand may hit infrastructure constraints.

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Data Sources for This Publication
U.S. Energy Information Administration
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To discover more about the data sources used, click here.

Plugging the Gap

With rising production, temporary constraints on the original Keystone pipeline since a leak last November, and new pipelines unlikely to be in service until the second half of 2019, Western Canadian crude producers need rail transport to get incremental crude to the critical Gulf Coast market. Because of the constraint, discounts for Canadian benchmark Western Canada Select have averaged over $20/barrel since November to cover the increased cost of rail transportation. Since this crunch is likely to continue for at least 18 months, question marks have arisen around the ability of rail infrastructure to plug the takeaway gap. This note looks at how prepared rail infrastructure and rolling stock are in Canada and the United States.

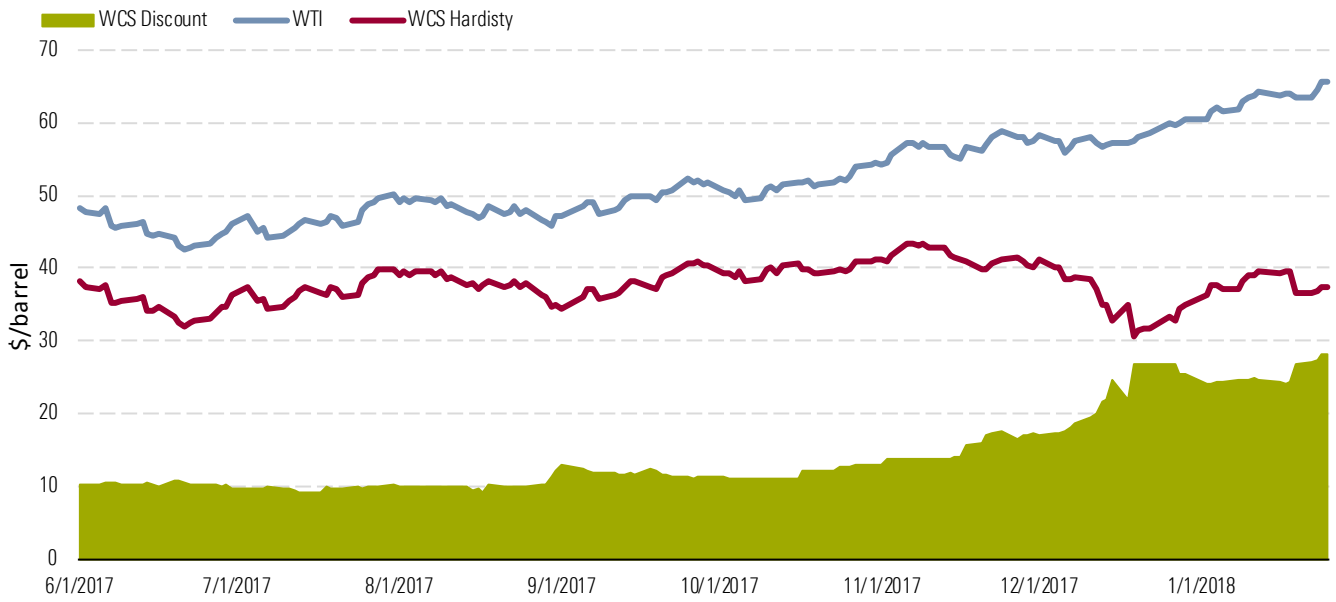
The Crunch Is On

As we noted last May, Western Canadian heavy crude production is growing ahead of pipeline capacity. That makes it increasingly difficult and expensive to get the crude to its only current growth market: sophisticated Gulf Coast refineries that can process heavy crude (see "Oil Sands Growth Tightens Canadian Takeaway Capacity"). In a follow-up note last June, we described how the pipeline constraint was pushing new production onto rail as an alternative (see "Pipeline Congestion Revives Cushing Rail Option"). According to the National Energy Board, average monthly Western Canadian crude production increased from 3.7 million barrels/day in 2016 to 4.0 mmb/d in 2017, meaning an extra 0.3 mmb/d of crude needed to find a way to market last year. More crude production is expected on line in 2018, including at least 100 thousand barrels/day of crude during the first year of production at the Suncor Fort Hills mine that saw first oil in December 2017. Crude by rail data estimates by the NEB show Canadian shipments between January and October 2017 (latest data) averaged 128 mb/d, up 59% over the same period in 2016.

The pipeline constraint came to a head in November with the TransCanada Keystone leak noted above that shut down the 590 mb/d pipeline for 12 days and has reduced its capacity since by 20%. The result was a pileup of crude in Alberta inventory during November and a widening of the price discount producers had to swallow for their crude. Exhibit 1 shows prices for WCS traded in Hardisty, Alberta, and the U.S. benchmark West Texas Intermediate at Cushing, Oklahoma. The WCS grade is normally discounted to WTI because of a location difference between Hardisty and Cushing and the fact that the U.S. benchmark is lighter and easier to process. Between June and the end of October 2017, that discount averaged $10.75/barrel. After the Keystone leak, the average discount jumped $10/barrel to $20.34, trading at a four-year low of $28.15/barrel on Jan. 24, 2018. These discounts reflect the higher cost of rail transportation to bypass the congestion. The typical rail cost to ship heavy oil from Hardisty to

the Gulf Coast is about $14/barrel with gathering system and terminal costs on top of that. The equivalent pipeline fee is $8/barrel or less.

Exhibit 1 WCS Discount to WTI



Source: CME Group, Morningstar

All Aboard

Given the need for crude by rail to take up the slack, we looked at available rail terminal capacity to load crude in Canada. Many rail terminals have been purpose-built in North America during the past seven years to facilitate loading crude onto dedicated unit trains of 100 or more rail tank cars. Unit trains are akin to a "pipeline on wheels" and have the advantage of flexible destination as well as efficiency, although rail freight is higher than pipelines. In Canada, five of these unit train terminals have been built at or near the main crude gathering and trading hubs of Edmonton and Hardisty, Alberta. Exhibit 2 lists these terminals, their owners, locations, and load capacities totaling 590 mb/d.

Exhibit 2 Canadian Crude by Rail Unit Train Load Terminals

Owner/Operator	Railroad	State	Location	Facility Type	Capacity mb/d
Cenovus	CN/CP	AB	Bruderheim "NATO" Terminal	Unit Rail Incoming pipeline	100
Gibson Energy	CN/CP	AB	Edmonton	Unit Trains	60
Keyera/Kinder MorganCanada	CN/CP	AB	Edmonton - Alberta Crude Terminal	Unit Trains	40
Kinder Morgan Edmonton	CN/CP	AB	Edmonton - Imperial	Unit Trains	210
Gibson Energy/USD Group	CP	AB	Hardisty	Unit	180
				Total	**590**

Source: Morningstar

In addition to these five unit train terminals, there are at least another 24 smaller terminals that can load smaller dedicated trains or tank cars mixed in with other freight in manifest trains. These shipments take longer to deliver and are generally less efficient. They have developed because they are located closer to remote oil sands production plants in northern Alberta and in some cases can ship heavy bitumen oil in insulated tank cars, reducing the need for lighter hydrocarbon diluents blended with raw bitumen to facilitate pipeline flow. These insulated tank cars need special steam-heated unload facilities at the delivery end but can save enough on diluent to compete with pipeline alternatives. For the most part, these smaller manifest terminals are not suited to plug the Canadian crude takeaway gap because the latter primarily consists of diluted "dilbit" crude delivered to Hardisty or Edmonton by pipeline that can't find room on the crowded mainline pipes to the U.S.

To that end, at least for the next three years, the existing unit train terminals have adequate capacity to cope with demand, as long as there are destination terminals to unload crude for distribution to Gulf Coast refineries as well as adequate rolling stock to carry the barrels. We look first at destination terminals.

Next Stop Gulf Coast

Fortunately for Canadian producers, the arduous history of cross-border pipeline permitting—typified by the TransCanada Keystone XL project that is still waiting for final approvals in Nebraska—means that plenty of crude-by-rail delivery terminals have sprung up all along the Gulf Coast. Canadian crude by rail has also been delivered to terminals in the Midwest, where barrels can be transferred to barges for onward shipment down the Mississippi River system to the Gulf Coast or into pipelines via the Cushing trading hub. Exhibit 3 lists the main destination terminals by delivery region and facility type with total capacity over 1.8 mmb/d that is more than enough to handle increased shipments out of Canada..

Exhibit 3 Gulf Coast Crude by Rail Unload Terminals

Owner/Operator	Railroad	State	Location	Facility Type	Capacity mb/d
Eastern Gulf Coast					
Genesis Energy	BNSF and UP	LA	Raceland	Unit Rail to pipeline	140
Genesis Energy	KCS and CN	LA	Baton Rouge	Heated Unit Train	140
Genesis Energy	BNSF	FL	Walnut Hill	Unit train to Jay pipeline	75
Genesis Energy Natchez	CN via Natchez Railway	MS	Natchez	Rail to barge. Heating facility, Unit trair	50
EOG/NuStar	UP	LA	St. James	Rail to river/pipe	280
Plains/US Development	UP	LA	St. James	Rail to river/pipe	140
Murex and Bulk Resources	BNSF, CN, KCS, CSX	LA	Port of New Orleans	1 Unit train/day	77
Western Gulf					
Jefferson Refining	KCS, UP and BNSF	TX	Beaumont	Rail to Barge/Steam Heat	140
Watco Express Greens Point	BNSF, UP, KCS	TX	Houston Ship Channel	Unit Train Dilbit	140
Texas International Terminals	UP/BNSF	TX	Galveston	Rail to Barge	90
Valero	KCS	TX	Port Arthur	Refinery unload	70
GT Logistics / Cokinos Energy	KCS, UP and BNSF	TX	Port Arthur GT Omniport	Unit Train to Barge	160
Midwest					
Valero	CN	IL	Hartford	Pipe & Rail to Barge	65
Arc Logistics	CN	IL	Joliet - XOM Refinery	Rail to Barge	85
Marquis	BNSF	IL	Hannepin Illinois River	Rail to Barge	35
USD Group	Stillwater Central	OK	(Cushing) Stroud	Rail to pipe	60
Gateway Terminals (Seacorp)	CP, CN, KCS, UP, BNSF	IL	Sauget (St. Louis)	Rail to Barge - Heating facility	65
				Total	**1,812**

Source: Morningstar

As with the load terminals in Canada, we only list the larger facilities that can handle unit trains. The 17-strong list provides considerable destination flexibility for shippers including access to refineries on the eastern Gulf Coast in Louisiana and Mississippi and the western Gulf region (Texas). The Midwest facilities offer the option of delivery to Cushing (USD Group's Stillwater, Oklahoma, facility) as well as into Illinois for delivery to Midwest refineries such as ExxonMobil's 260 mb/d Joliet, Illinois, refinery or to barge terminals on the Illinois and Mississippi rivers for onward shipment to the Gulf Coast. Rail-to-barge terminals are a flexible alternative because shippers can deliver to most Gulf Coast refiners by barge once on the water, whereas a refinery rail unload terminal has only one delivery point.

Shrinking Stock

With adequate load and delivery terminal capacity already available, the only other constraint to consider is the number of rail tank cars in the fleet. Although crude-by-rail volumes are down significantly in 2018 versus the heyday of 2013, the fleet has shrunk considerably due to legislation to remove older designs following a slew of accidents.

The number of accidents involving crude-by-rail trains in both Canada and the U.S. increased between 2012 and 2015 as rail shipments climbed to alleviate pipeline logjams caused by booming shale production. The worst of these accidents, the Lac-Mégantic tragedy in July 2013, claimed 47 lives. Subsequent legislation in Canada and the U.S. required phasing out a large part of the rail tank car fleet built to older standards by the end of 2017. A U.S. Department of Transportation report published in July 2017 ("Fleet Composition of Rail Tank Cars that Transport Flammable Liquids") indicated that partly due to retirement of older tank cars and partly due to lower demand for crude-by-rail shipments as pipelines have been built out, the crude-by-rail tank car fleet shrank from 28,899 at the end of 2013 to 17,312 at the end of 2016, a 40% reduction. Of the 17,312 cars operating at the end of 2016, 366 are now obsolete and 5,164 were insulated tank cars unsuited to shipping dilbit crude from Canada. That left a fleet of 11,171 crude rail tank cars available at the start of 2018 plus an unknown number of 2017 new builds. The number of new builds added in 2016 was 1,008 cars based on low demand so we estimate double that output in 2017 would have added 2,000 cars for an estimated total fleet of 13,200 tank cars.

Fleet Math

Crude-by-rail shipments continued to decline in 2017, particularly after the June in-service of the Dakota Access pipeline that competes directly with rail. The latest Energy Information Administration data indicates October 2017 crude-by-rail shipments were 360 mb/d versus an annual average 481 mb/d in 2016. We estimate that the October 2017 crude-by-rail volume would require the use of about 6,000 rail tank cars, using the following logic:

- A typical unit train carries 60,000 barrels of crude (100 x 600 barrel tank cars) so that 360 mb/d can be loaded onto six unit trains using 600 tank cars. However, the tank cars are not available for reuse until they have delivered to the destination and returned to the origin, meaning the journey time is significant. Based on a 10-day round trip, the 360 mb/d of crude requires (10 x 600) = 6,000 tank cars to keep up a 360 mb/d flow.

- Based on that estimate of 6,000 cars in use and 13,200 available cars in 2018, it sounds as if the fleet is flexible enough to meet additional Canadian requirements. For example, to ship 100 mb/d of Canadian crude from Hardisty to St. James, Louisiana (assuming 600 barrels per tank car), would require 167 tank cars each day. The roundtrip cycle time on that journey is 12 days, meaning the fleet required to keep up a daily flow would be (12 x 167) or 2,004 tank cars. Adding the 2,000 to our existing 6,000 cars in use adds up to 8,000 cars or 61% of the 13,200 cars in the fleet.

  On paper that math works, and the rail tank car fleet should be adequate. However, we do not know how much of the existing fleet is already under term lease or otherwise unavailable. In addition, journey times for rail shipments are subject to delays, maintenance, and so on, and that means more cars are needed to cover any slack time in the schedule. Given the long journey time from Alberta to the U.S. Gulf, we consider that a tank car fleet constraint is likely very real.

  Anecdotal evidence reported by Reuters also suggests that Canadian railroads have been reluctant to offer short-term service to producers looking to shift barrels to rail. They are insisting that shippers sign long-term take-or-pay commitments for specific volumes. The railroads are reluctant to commit resources to rail shipments that may quickly fizzle out when pipelines are built or expanded.

Conclusion

Our conclusion is that rail infrastructure will probably be able to handle an increase in Canadian crude traffic in the short term but that shrinkage in the tank car fleet is going to be a constraint on the system. Together with railroad reticence and increasing crude production volumes needing to find a route to market, these factors will leave Canadian producers vulnerable to continued heavy discounts over the next 18 months.

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