Re-evaluating the Need for the Trans Mountain Expansion Project: the Impacts of Weaker Oil Markets and Keystone XL

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April, 2017

Research Report 2017-03-1

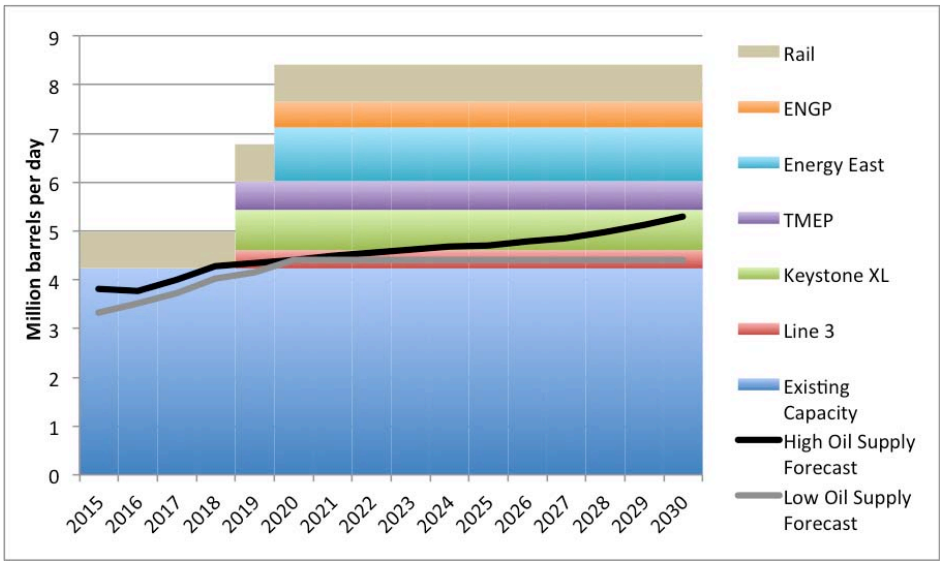
Executive Summary

1. On November 29, 2016, the Canadian government approved the Kinder Morgan Trans Mountain Expansion Project (TMEP) based on recommendations by the National Energy Board (NEB) submitted in May 2016.

2. Since the completion of the NEB's evaluation of the TMEP application, there have been material changes in oil markets that **undermine the rationale for building the TMEP**. Key changes include:
    - US approval of Keystone XL Pipeline on March 24, 2017
    - Recent downward adjustments in oil price and Canadian oil production forecasts by the International Energy Agency (IEA, November 2016) and the National Energy Board (NEB, October 2016)
    - Reduction in the Canadian Association of Petroleum Producers forecast of Western Canadian (WCSB) oil supply (2030 forecast reduced by 2.0 million barrels per day (bpd) over last two years)

3. This report evaluates the impact of these changes on the need for the TMEP by assessing the overall supply and demand for Western Canadian oil transportation services. The analysis shows that potential transportation capacity far exceeds demand throughout the forecast period to 2030 (Figure E-1).

Figure E-1: Supply and Demand for WCSB Oil Transportation, 2015-2030



4. The need for new oil pipelines is assessed using three alternative supply and demand scenarios:
    - a high growth oil supply scenario with **no** rail transportation

- a high growth oil supply scenario with rail transportation
- a low growth oil supply scenario with **no** rail transportation

5. Under the low growth oil supply scenario **no new pipelines** are required during the forecast period to 2030 other than the Enbridge Line 3 Replacement. Construction of additional proposed pipeline projects (TMEP, Energy East, and Keystone XL) would result in 2.7 million bpd of excess pipeline capacity in 2025 and if just TMEP and Keystone XL are built there would be 1.6 million bpd of excess capacity (Table E-1).

6. Under the high growth oil supply scenario with some rail shipments, **no new pipelines** are required during the forecast period until 2030 other than the Enbridge Line 3 Replacement. Construction of additional proposed pipeline projects (TMEP, Energy East, and Keystone XL) would result in 3.0 million bpd of excess pipeline capacity in 2025 and if just TMEP and Keystone XL are built there would be 1.9 million bpd of excess capacity (Table E-1).

7. Under the high growth oil supply scenario with no rail shipments, no new pipelines are required until 2023 other than the Enbridge Line 3 Replacement. In 2023 only one of the new pipelines (TMEP, Energy East, or Keystone XL) are required. Construction of all three pipelines would result in 2.4 million bpd of surplus pipeline capacity in 2025 and if just TMEP and Keystone XL are built there would be 1.3 million bpd of excess capacity (Table E-1).

Table E-1: Oil Pipeline Supply and Demand Balance 2025 (thousands of bpd)

	High Growth With Rail	**High Growth No Rail**	**Low Growth No Rail**
Oil Supply Forecast	4712	4712	4409
Current Transport Capacity	4782	4232	4232
Surplus/Deficit	**70**	**-480**	**-177**
Enbridge Line 3 Expansion	370	370	370
Surplus/Deficit	**440**	**-110**	**193**
Keystone XL	830	830	830
Surplus/Deficit	**1270**	**720**	**1023**
Kinder Morgan TMEP	590	590	590
Surplus/Deficit	**1860**	**1310**	**1613**
Energy East	1100	1100	1100
Surplus/Deficit	**2960**	**2410**	**2713**

8. Shippers' contracts are cited by Trans Mountain as evidence that the pipeline is needed. The problem is that these contracts were signed before the recent downturn in oil markets and approval of other pipelines. Consequently, the contracts do not reflect current market conditions or need for the TMEP.

9. TMEP faces two challenges that could block construction: court challenges and rising costs of construction or project delays. Nonetheless, the probability of the TMEP being built even though it is not needed is high. The long term shippers' contracts signed by Trans Mountain before the current downturn in oil markets provide the

financial incentive for the TMEP to be built even if it is not required because shippers are legally required to pay the tolls on the TMEP whether they use it or not. If the TMEP is built, oil producers would divert shipments from existing transportation facilities (eg. Enbridge pipelines) that do not have contracts. The costs of the empty space would be borne by other shippers in terms of higher tolls and Canadian governments in the form of reduced tax revenue from the oil sector.

10. There is a high probability that Trans Canada will build only one of its two proposed pipelines- Energy East or Keystone XL- not both. Keystone XL is more likely than Energy East because it is approved and a large portion of the Keystone XL project is already built. However, even if Energy East is not built, the TMEP is still not required and building the TMEP will result in between 1.3 and 1.9 million bpd of surplus capacity in 2025.

11. Given the fact that more pipeline projects are proposed than required under all scenarios, it is important to complete a comprehensive benefit cost assessment that evaluates all proposed projects from a social, economic, and environmental perspective to determine which project or mix of projects are required and best meet Canada's public interest.

12. An important factor in assessing the merits of alternative pipeline proposals is the environmental impact. A major environmental disadvantage of TMEP relative to Keystone XL and the Enbridge Line 3 Replacement is that TMEP requires tanker traffic that the NEB concluded will create significant adverse environmental effects on whales, Aboriginal culture and greenhouse gas emissions in BC. TMEP also has a high risk of risk of marine tanker oil spills over a 50 year operating life (Table E-2). Keystone XL and Enbridge Line 3 expansion involve no tanker spill risk.

Table E-2: Probabilities for TMEP Tanker, Terminal, or Pipeline Spills

Type of Spill	Spill Probability over 50 Years
Tanker Spill (range of estimates)	16- 98%*
Tanker Spill (mid- point of estimates)	57%
Terminal Spill (TM estimate)	77%
Pipeline Spill (TM estimate)	99%
All Spills	99%

Source: Gunton and Broadbent, (2015) * There are a number of deficiencies in TM's oil spill risk analysis that mean that the lower end range of 16% significantly underestimates the likelihood of a spill and should not be relied on.

13. An alleged advantage of the TMEP is the benefit of market diversification and higher prices relative to other pipelines. There is little to no merit to this justification for the TMEP. All four of the proposed pipelines (Enbridge Line 3, Energy East, Keystone XL and TMEP) can ship oil to tidewater locations and receive the same world market prices. The advantage of Enbridge Line 3 and Keystone XL is that they can achieve

these same economic benefits of TMEP with fewer environmental risks.

14. Recent forecasts by the federal government show that under current policies (as of November 1 2016) Canada will not meet its climate change targets. The oil and gas sector are the principal contributor to GHG emissions growth to 2030. Therefore, as part of this evaluation of pipelines, Canada should assess the level of oil production and pipeline expansion that is consistent with Canada meeting its climate change commitments.

15. **The key findings of this report are**:

    a. Recent developments in oil markets, climate change policies, and the US approval of Keystone XL have undermined the rationale for building the TMEP because there are alternatives to the TMEP that can achieve similar economic benefits with no environmental risks to Canada's and BC's marine environment from oil tanker traffic.

    b. The decision of the federal government to approve the TMEP was based on outdated information that does not reflect current oil market conditions and a deficient evaluation process that assessed each pipeline proposal separately without adequately taking alternative projects and the overall supply and demand for oil transportation into account.

    c. The decision to approve both the TMEP and Enbridge Line 3 along with the US approval of Keystone XL could result in the construction of more than $25 billion of excess pipeline capacity. This excess pipeline capacity will impose a significant cost on the oil sector in higher tolls and on Canadian tax payers in the form of reduced tax revenue from the oil industry.

    d. Given the significant change in oil markets and transportation options, the federal government should:

        i. Publish a climate change strategy that identifies what level of Canadian oil production is consistent with Canadian climate change targets to reduce GHG emissions by 30% by 2030.

        ii. Complete a comprehensive evaluation of oil transportation options and identify the options that best meet Canada's public interest from an economic, social, and environmental perspective and ensure that only those projects that are required and in Canada's public interest are built.

About the Author: Dr. Thomas Gunton is Professor and Director of the Resource and Environmental Planning Program in the School of Resource and Environmental Management at Simon Fraser University. He has held various senior positions in government including Assistant Deputy Minister of Energy and Mines (Manitoba), Deputy Minister of Finance and Secretary of Treasury Board (BC), Deputy Minister of Environment (BC) and has been an expert witness before a number of tribunals including the National Energy Board and the Ontario Energy Board, and has spent the last 15 years researching energy markets, pipelines and major resource project development. Dr. Gunton has published over 80 refereed articles in scientific journals and over 100 technical reports for private and public sector clients on resource and environmental issues and project development.

Introduction

The purpose of this report is to assess the need for the Kinder Morgan Trans Mountain Expansion Project (TMEP) in light of recent developments in the oil market and oil transportation sector including:

- US approval of Keystone XL Pipeline on March 24, 2017
- Recent downward adjustments in oil prices and Canadian oil production forecasts by the International Energy Agency (IEA, November 2016) and the National Energy Board (NEB, October 2016a)
- Reduction in the Canadian Association of Petroleum Producers forecast of Western Canadian (WCSB) oil supply (2030 forecast reduced by 2.0 million bpd over the last two years)

The report begins with an estimate of current and forecast Western Canadian Sedimentary Basin (WCSB) oil transportation capacity and oil production. The supply and demand for oil transportation capacity is assessed under several scenarios to determine the need for new oil pipelines and the need for the TMEP. The report concludes with a discussion of the policy implications of the findings.

Oil Transportation Capacity

Existing and proposed transportation projects based on CAPP (2016) data are summarized below (Table 1). Current WCSB pipeline capacity is 4,232 kbpd and current rail capacity is estimated at 754 kbpd, resulting in a combined current capacity of 4,986 kbpd. The total capacity of proposed pipelines is 3,415 kbpd, resulting in a total potential capacity of 8,401 kbpd. It should be noted that because several of the proposed pipelines have the potential to increase capacity beyond the capacity estimates in Table 1, potential capacity is higher than 8,401 kbpd. The status of proposed projects is as follows:

- Enbridge Line 3 Replacement was approved by Canada on November 29, 2016 and is under review by US regulators. The likelihood of completion of the Enbridge Line 3 project is high given that it is a replacement of an existing pipeline.
- Enbridge Northern Gateway was approved by Canada in 2014, but approval was overturned by the courts in 2016 and rejected by Canada in November, 2017. *Therefore,*

Enbridge Northern Gateway is listed in Table 1 but is not included in the supply and demand analysis.

- TMEP was approved by Canada on November 29, 2016 and by BC in January 2017. The TMEP faces several obstacles including court challenges and rising cost estimates (from $5.5 billion in 2013 to $7.4 billion in 2017). Although shippers recently confirmed 97% of the committed volumes based on the higher capital costs (Trans Mountain, 2017), further cost increases or timing delays could jeopardize the financial viability of the TMEP. Another risk is that increased competition from other pipelines could reduce demand for spot shipments on the TMEP, which are forecast to comprise one-fifth of TMEP shipments.
- Energy East is under review by the NEB. The likelihood of Energy East being built is lower due to the recent approval of Keystone XL and rising capital cost estimates.
- Keystone XL was approved by Canada in 2010 and by the US government in March 2017. Keystone still requires approval of some state governments. Trans Canada is more likely to build Keystone XL than Energy East because a large proportion of the Keystone XL Project is already built and it has been approved by the NEB and the US government.

Table 1: Existing and Proposed WCSB Oil Transportation Capacity

Facility	**Capacity (kbpd)**
Enbridge Mainline	2,851
Express/Milk River/Rangeland	490
Trans Mountain	300
Keystone	591
Existing Subtotal*	**4,232**
Enbridge Line 3 (2019)	370*
Kinder Morgan TMEP (2019)	590
Energy East (2021)	1,100
ENGP (rejected by Canada in 2016)	*525**
Keystone XL (2019)	830*
Subtotal Existing and Proposed Pipeline	**7,647**
Rail[2] (2018)	754
Total Existing and Proposed Pipeline and Rail	**8,401**
Total Existing and Proposed Pipeline and Rail (no ENGP)	**7,876**

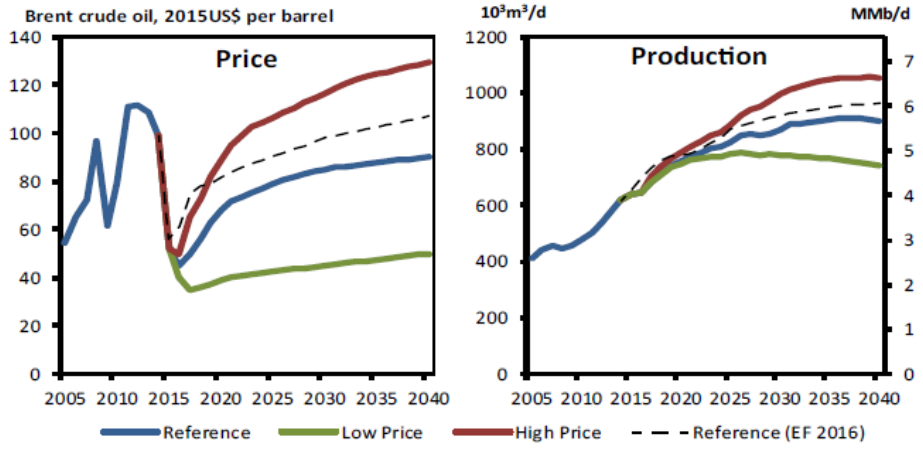
Sources: CAPP (2016). Forecast in service dates are in brackets. Express capacity from Ensys (2011)

Oil Production and Demand for Transportation

Currently, there is significant uncertainty in oil markets and forecasts for Canadian oil production, with more recent forecasts becoming increasingly pessimistic. The International Energy Agency's includes two long-term oil price forecasts in its 2015 forecast (IEA, 2015): the high forecast assumes that oil prices remain below $80 until 2020 and then gradually rise to over $100 while the low forecast assumes oil prices remain in the $50 to $60 range until 2020 and then gradually rise to approximately $85 by 2048. Under the low price forecast, the IEA predicts very little expansion in oil production in Canada. The most recent IEA forecast released in November 2016 (IEA, 2016) forecasts that under its new policies scenario oil prices will remain in the $80 range until 2040. The IEA notes oil drilling in Canada has fallen to its lowest level in 40 years and forecasts that with completion of current projects under construction, oil sands production will grow from 2.4 mbpd in 2015 to 3.1 mbpd in 2020, but then growth will level off, expanding to only 3.3 mbpd by 2030 (IEA, 2015, p. 136).

The National Energy Board (NEB) updated forecast released in October 2016 (NEB, 2016a) is more pessimistic than the NEB forecast produced earlier this year, with the 2040 oil prices forecast reduced by $17 per barrel and the 2040 production forecast reduced by almost 400,000 bpd from the its earlier 2016 forecast (Figure 1). The updated forecast provides three scenarios: a reference case, high price case and a low price case. The reference case forecasts oil prices gradually rising to the $80 per barrel range from 2020-30. The low price forecast assumes that oil prices remain below $50 per barrel while production peaks in the mid-2020s and gradually declines thereafter. The NEB's low price Canadian oil production forecast is similar to the IEA's Canadian forecast under its new policies scenario. The high price scenario assumes oil prices rise above $100 per barrel. The NEB notes that its updated forecast does not incorporate the impacts of Canada's future climate change policies, which will further reduce fossil fuel production. Therefore, the current NEB forecast likely overestimates oil production.

Figure 1: NEB Oil Price and Production forecasts, October 2016

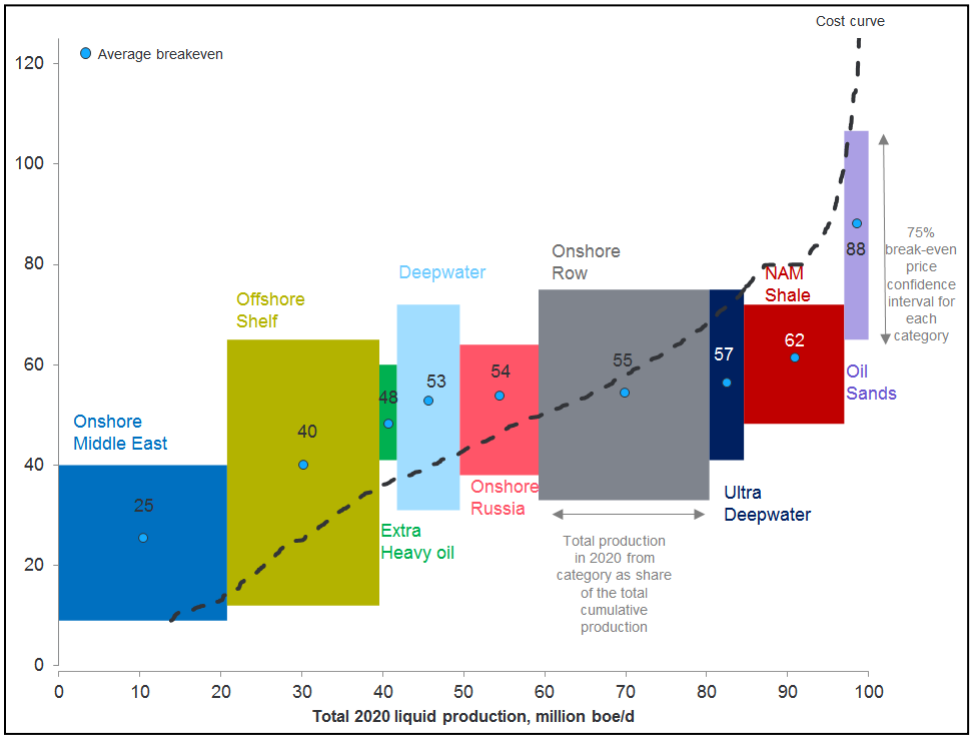


Oil production forecasts produced by the Canadian Association of Petroleum Producers (CAPP) are also increasingly pessimistic. The most recent forecast for WCSB oil supply in 2030 (CAPP, 2016) is 2.0 million bpd lower than the 2014 forecast (CAPP, 2014). In its 2015 forecast, CAPP concludes that "given the challenge of developing a forecast in the current low oil price environment, a range is presented" (CAPP, 2015, p.ii). For its lower range forecast, CAPP assumes that existing projects under construction are completed with no new projects being started during the forecast period. Under this scenario, WCSB production increases by about 700 kbpd from 2015 to 2020 and then gradually declines to 2030. Under its higher growth forecast CAPP assumes that oil markets recover and new projects are started. In its most recent 2016 production forecast, CAPP (2016) provides only one growth forecast based on the assumption of new projects, which forecasts an increase of 1,158 kbpd from 2015 to 2030 in WCSB production. CAPP's lower range 2015 forecast is similar to IEA's new policy scenario and the NEB's low price scenario that forecast little to no expansion in production from 2020-30 after the projects currently under production are completed.

These increasingly pessimistic oil price forecasts and new climate change policies are particularly critical for Canadian production because Canadian oil sands production is at the high end of the international cost curve (Figure 2) and will, therefore, be more impacted by market conditions than other world production (IEA, 2016). The Canadian Energy Research Institute (CERI) (2014) estimates that WTI prices (2013 US $) needed to justify oil sands expansion are $85 for *in situ* SAGD projects and $105 for mine projects. While some oil sands projects will have higher or lower supply costs than CERI's average estimates and some producers have been able to reduce costs even further (Leach, 2015), many previously planned greenfield projects are

unlikely to be developed at current WTI prices. Lower oil prices and climate change policies that increase costs will therefore have dramatic impacts on Canadian production (McGlade and Ekins, 2015).

Figure 2: Oil Production Cost Curve (US $ per B.)



Source: Rystad Energy Research and Analysis (2015).

To reflect this uncertainty in oil markets, the demand forecast for oil transportation services used in this report uses two scenarios: a low production scenario based on completion of existing projects with no new projects being built to 2030 and a high production scenario based on CAPP's 2016 growth scenario that assumes a recovery in oil markets and commencement of new projects. The lower production forecast is similar to the IEA new policies scenario and the NEB's low price scenario. Given that the production capacity that underlies this scenario is under construction or already operating, this scenario provides a fairly reliable lower bound estimate of oil production.

The higher production scenario uses CAPP's 2016 supply forecast. However, there are several reasons why this forecast may be too optimistic. First, CAPP's forecasts have historically over-estimated oil production. In its review of the Keystone XL pipeline the US government

provides a comparison of CAPP forecasts with actual production and concludes "The CAPP forecasts generally have overestimated potential production compared to the trend of actual production" (USDS 2013, Vol 1.4-24). Second, since the CAPP forecast was prepared earlier this year, oil price and production forecasts have become increasingly pessimistic. Third, as the NEB cautions, current CAPP and NEB production forecasts do not take into account the impact of future climate change policies (NEB, 2016a, p. 5). As the IEA's new policies forecast released in November 2016 shows, these policies are likely to result in little to no growth in Canadian oil production after the completion of current projects under construction. For these reasons, the CAPP 2016 growth forecast likely over-estimates WCSB oil production.

Supply/Demand Analysis for Oil Transportation

Forecast supply and demand for WCSB oil transportation capacity are estimated based on the three scenarios. All scenarios exclude the Enbridge Northern Gateway.

The first scenario is a high production scenario based on CAPP's 2016 WCSB oil supply forecast and the phasing out of all oil shipments by rail (Table 2). Under this scenario, the Enbridge Line 3 Replacement meets transportation demand until 2023, at which point additional capacity is required. If Keystone XL is constructed, there is enough transportation capacity to meet demand to the end of the forecast period (2030) without construction of the TMEP.[1] If TMEP is built along with Keystone XL, there would be excess pipeline capacity beyond 2030. Excess pipeline capacity in 2025 would be 1.3 million bpd and if Energy East is also built, there would be 2.4 million bpd of excess capacity.

[1] Pipeline capacity would be almost fully utilized at the end of the forecast period (2030) under this scenario. Therefore some incremental expansion of existing capacity or rail may be required around 2030 if the high growth scenario materializes.

Table 2: Oil Pipeline Supply and Demand Balance: High Growth Forecast, no Rail (thousands of bpd)

	2015	2020	2025	2030
Oil Supply Forecast*	3821	4409	4712	5295
Current Pipeline Capacity	4232	4232	4232	4232
Surplus/Deficit	**411**	**-177**	**-480**	**-1063**
Enbridge Line 3 Expansion		370	370	370
Surplus/Deficit	**411**	**193**	**-110**	**-693**
Keystone XL		830	830	830
Surplus/Deficit	**411**	**1023**	**720**	**137**
Kinder Morgan TMEP		590	590	590
Surplus/Deficit	**411**	**1613**	**1310**	**727**
Energy East		1100	1100	1100
Surplus/Deficit	**411**	**2713**	**2410**	**1827**

*Forecast is based on CAPP's 2016 WCSB supply forecast. CAPP's oil supply forecast adjusts their oil production forecast to include the extra volume of diluents mixed with bitumen to allow it to be transported in pipelines (CAPP, 2016, p.39). CAPP's oil supply forecast has been further adjusted by deducting WCSB refinery consumption (595 kbpd); adding refined product shipments and Bakken shipments on Enbridge Mainline and refined product shipments on TMEP (435 kbpd) for a net reduction in oil supply of 160 kbpd. See Gunton et al. (2015) for more detailed discussion of adjustments.

The second scenario is also based on CAPP's 2016 WCSB oil supply forecast but includes some rail capacity in addition to forecast pipeline capacity (Table 3). The role of rail in oil shipments is subject to uncertainty on the merits of rail versus pipelines. CAPP identifies a number of advantages of rail relative to pipelines including: lower capital costs, shorter lead times to add capacity, shorter shipment times, option and flexibility benefits to reach alternative markets, and high product integrity (CAPP, 2015, p. 32). For these reasons, rail is an attractive option in an uncertain environment because unlike pipelines, rail capacity is flexible and can be reallocated to other locations and products if demand for oil shipments declines. CAPP, however, assumes that despite these potential advantages, pipelines are preferred to rail and rail will only be used if pipeline capacity is not available. This is the assumption used in the first scenario which assumes that rail shipments of oil are phased out. Other evidence submitted by Trans Mountain in NEB hearings as well evidence submitted in Keystone XL hearings concludes that rail is cost competitive with pipelines (Schink, 2013, App. A; USDS 2014, Vol. 1.4 p. 1.4-87-89).

Given the viability of rail and the current rail capacity, it is prudent to consider a scenario in which some oil is shipped by rail. To assess the impact of rail, this second scenario assumes that rail shipments are 550 kbpd, which is CAPP's mid-point forecast for rail under constrained pipeline options (CAPP, 2015, p.32). This is still well below existing rail capacity of 754 kbpd. Under this scenario no new pipeline capacity is required until 2023 and with completion of the

Enbridge Line 3 expansion, no additional pipeline capacity is required during the forecast period until 2030 (Table3). Construction of just one additional major pipeline such as Keystone XL would create 1.3 million bpd of surplus pipeline capacity in 2025.

Table 3: Oil Pipeline Supply and Demand Balance: High Growth Forecast with Rail (thousands of bpd)

	2015	**2020**	**2025**	**2030**
Oil Supply Forecast*	3821	4409	4712	5295
Current Pipeline and Rail Capacity	4782	4782	4782	4782
Surplus/Deficit	**961**	**373**	**70**	**-513**
Enbridge Line 3 Expansion		370	370	370
Surplus/Deficit	**961**	**743**	**440**	**-143**
Keystone XL		830	830	830
Surplus/Deficit	**961**	**1573**	**1270**	**687**
Kinder Morgan TMEP		590	590	590
Surplus/Deficit	**961**	**2163**	**1860**	**1277**
Energy East		1100	1100	1100
Surplus/Deficit	**961**	**3263**	**2960**	**2377**

* Forecast is based on CAPP's 2016 WCSB supply forecast. CAPP's oil supply forecast adjusts their oil production forecast to include the extra volume of diluents mixed with bitumen to allow it to be transported in pipelines (CAPP, 2016, p.39). CAPP's oil supply forecast has been further adjusted by deducting WCSB refinery consumption (595 kbpd); adding refined product shipments and Bakken shipments on Enbridge Mainline and refined product shipments on TMEP (435 kbpd) for a net reduction in oil exports of 160 kbpd. See Gunton et al. (2015) for more detailed discussion of adjustments.

The third scenario is based on a lower oil supply forecast that assumes completion of existing WCSB projects under construction, with no new projects during the forecast period and no oil transport by rail. This scenario is similar to CAPP's 2015 lower range scenario, the IEA's new policies scenario, and the NEB's low price scenario. Under this scenario, no new pipeline projects are required to the end of the forecast period (2030), other than completion of the Enbridge Line 3 Replacement (Table 4). Completion of either Keystone XL or TMEP would result in excess pipeline capacity.

Table 4: Oil Pipeline Supply and Demand Balance: Lower Growth Forecast, no Rail (thousands of bpd)

	2015	2020	2025	2030
Oil Supply Forecast*	3821	4409	4409	4409
Current Pipeline Capacity	4232	4232	4232	4232
Surplus/Deficit	**411**	**-177**	**-177**	**-177**
Enbridge Line 3 Expansion		370	370	370
Surplus/Deficit	**411**	**193**	**193**	**193**
Keystone XL		830	830	830
Surplus/Deficit	**411**	**1023**	**1023**	**1023**
Kinder Morgan TMEP		590	590	590
Surplus/Deficit	**411**	**1613**	**1613**	**1613**
Energy East		1100	1100	1100
Surplus/Deficit	**411**	**2713**	**2713**	**2713**

* Forecast is CAPP's 2016 supply forecast based on completing current projects under construction with no new projects started during forecast period. Because CAPP 2016 forecast does not provide an estimate of production based on current projects under construction, CAPP's forecast production in 2020 is used as an estimate of operating and currently under construction production. CAPP's oil supply forecast adjusts their oil production forecast to include the extra volume of diluents mixed with bitumen to allow it to be transported in pipelines (CAPP, 2016, p.39). CAPP's oil supply forecast has been further adjusted by deducting WCSB refinery consumption (595 kbpd); adding refined product shipments and Bakken shipments on Enbridge Mainline and refined product shipments on TMEP (435 kbpd) for a net reduction in oil exports of 160 kbpd. See Gunton et al. (2015) for more detailed discussion of adjustments.

The conclusion of the supply and demand analysis is that under CAPP's high oil production scenario only two new pipelines are required during the forecast period to 2030. If existing rail capacity is utilized, only one new pipeline (Enbridge Line 3) is required under the higher oil production scenario. Under the lower oil production scenario, no major new pipeline projects other than completion of the Enbridge Line 3 Replacement are required to 2030. While some degree of surplus capacity is beneficial to provide some degree of flexibility in the oil transportation system, the magnitude of surplus capacity that could be created with completion of three or four of the proposed projects will be excessive.

Project Need and Creation of Excess Capacity

The conclusion of the supply and demand assessment is that construction proposed pipelines would create excess capacity. An obvious question is if the capacity is not needed, why would it be built?

The answer lies in the nature of contracting and the NEB approval process. The NEB reviews each pipeline project separately instead of comparing options and does not independently assess the overall supply and demand for transportation services. Instead, the NEB relies on project proponents to demonstrate the need for projects based on their market analysis and

indicators of market support such as signing of contracts. The NEB therefore has approved more projects than are required to meet the transportation needs of the Canadian oil industry.

Pipeline companies prefer getting oil producers to signed contracts obligating them to ship on proposed pipelines. Such "take or pay" contracts were signed for three of the proposed projects: TMEP, Keystone XL and Energy East. These contracts are cited by the companies as evidence that the projects are needed. The problem is that these contracts were signed by producers before the downturn in oil markets in 2014 and therefore do not reflect current market conditions. Even though the new capacity is no longer required, the existence of these contracts provides the financial incentive for these projects to be built because shippers would be legally required to pay tolls whether they used the project or not. What would happen if these projects are built is that oil producers would divert shipments from existing transporters (eg. Enbridge pipelines) that do not have contracts to meet their contractual obligation to ship on the new pipelines. This would result in empty space and lost revenue on existing pipelines that would be made up by toll increases that would reduce oil producer netbacks and royalty and tax payments to government. Overall, there would be a net cost to the oil sector and Canadian taxpayer due to building unneeded new capacity.

Other Considerations in Evaluating Alternative Projects

The supply demand analysis shows that under the lower production scenario only one new pipeline is required and under a high growth forecast with no rail shipments only two of the four proposed pipelines is required. A relevant question, therefore, is what factors should be taken into account in identifying which projects should be built to best meet Canada's public interest. The following factors are relevant in making this determination.

Market Diversification and Netbacks

One consideration is the impact of alternative pipelines on the netbacks received by shippers. An alleged advantage of the TMEP relative to other projects such as the Keystone XL and Enbridge Line 3 is that the TMEP will achieve a higher oil price for Canadian oil by diversifying markets. Reports commissioned by Trans Mountain, for example, conclude that diverting Canadian exports from the US to Asian markets will increase the price that Canadian producers receive because the reduction in shipments to the US will eliminate the need for more expensive rail shipments and reduce the supply of Canadian oil in the US market (Muse Stancil, 2015).

This argument that TMEP will increase prices for Canadian oil by eliminating the need for more costly rail transport is unfounded for several reasons. First, reports commissioned by Trans Mountain (Schink, 2013, App. A p. 18) as well as other studies (USDS, 2014, Vol. 1.4 p. 1.4-87-89; Fielden, 2013; Genscape, 2013) conclude that rail transport is **not** necessarily more expensive than pipelines and may in fact be lower cost depending on the technology and transportation logistics. Second, even if rail transport is more expensive, rail shipments are not required because with the construction of Enbridge Line 3 and Keystone XL there would be sufficient pipeline capacity without rail.

The argument that the TMEP will increase prices relative to other pipeline proposals by reducing supply to the US market and accessing higher priced Asian markets is also unfounded. The world oil market is an integrated single world market linked by shippers' ability to transport oil between geographic locations according to supply and demand dynamics; if demand and prices rise in one location, producers will increase supply to that location until the oil market equilibrates and price differentials disappear (Adelman, 1984; Kleit 2001; Nordhaus, 2009; Fattouh 2010; Huppmann and Holz, 2012). While there may be short-term impediments in oil markets that restrict adjustments in global supply, such as transportation logistics that result in temporary price differentials (e.g., the glut of oil in Cushing, Oklahoma that reduced the price of Canadian oil relative to the world price), the global oil market will erode these differences. As TM's expert and author of MS (2015) stated in NEB hearings on the Northern Gateway Project:

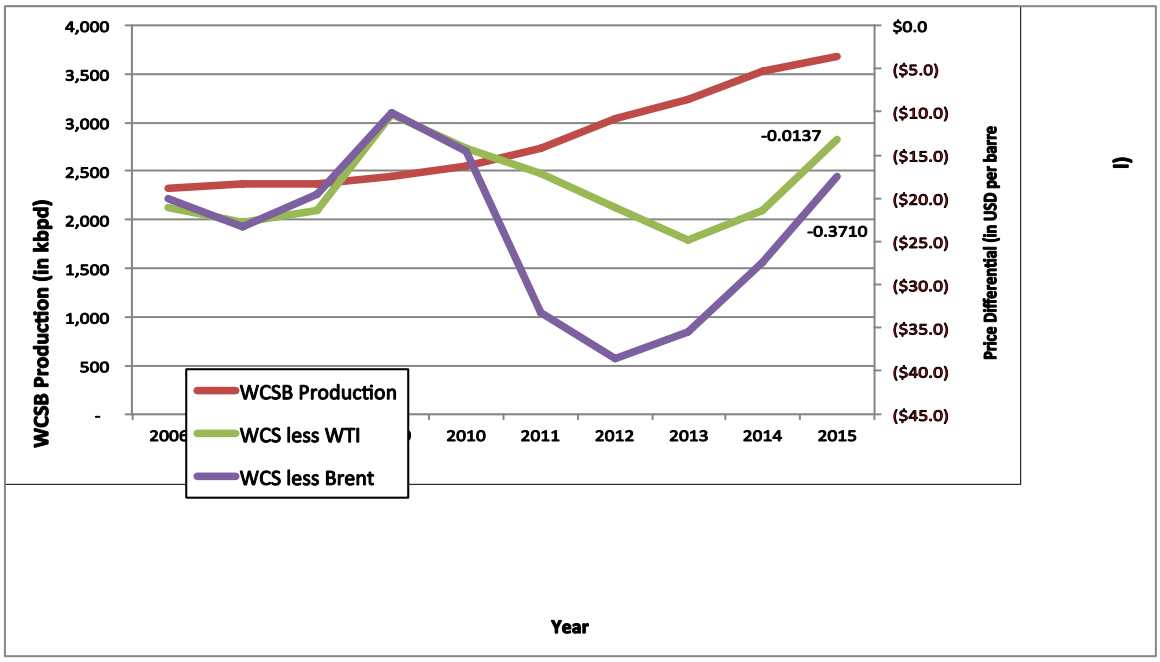
> And as you can kind of see from this chart here, I mean, millions and millions of barrels of crude are transported by waterborne -- on the water around the world. And accordingly the global crude market can pretty quickly re-equilibrate their prices. Oil prices are very high in one part of the world, you'll have more tankers starting to come into that part of the world and the price will equilibrate (Earnest, 2012, p. A47316).

This is borne out by the oil price data. As illustrated in Figure 3, the relative price of Canadian oil was discounted more heavily around 2012-13 due to short term bottlenecks in the pipeline system in the United States between Cushing, Oklahoma and the US Gulf. This so called "Canadian discount" disappeared with the elimination of the bottleneck and the relative price of Canadian oil actually increased with increased exports to the US. This price evidence is in direct contradiction to the suggestion that higher exports to the US will dampen Canadian export prices.

Further, there is no evidence showing that the oil price in Asian oil markets is consistently higher than the US. Although Asian prices were higher than European and US prices

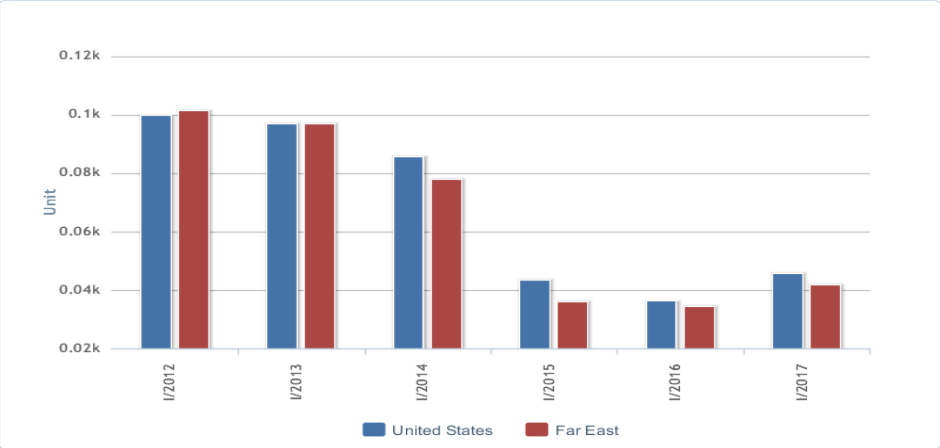
by up to $1.50 per barrel throughout the 1990s (Ogawa, 2003), price differentials have fluctuated between premiums and discounts (Cui and Pleven, 2010; Doshi and 'Souza, 2011; Broadbent, 2014, p.108-110) with no discernible pattern or trend line with which to forecast a long term premium. In fact, current US prices for heavy oil are actually higher than Asian prices (Figure 4). Over the long run, therefore, prices received for Canadian exports to the US Gulf on projects such as Keystone XL will be similar to Asian prices and there is no long run advantage to shipping to Asia.

Figure 3: Comparison of WCSB Production to Oil Price Differentials



Source: Gunton et al. (2015), p. 17.

Figure 4: Comparison of US and Asian Heavy Oil Price (US $/B)

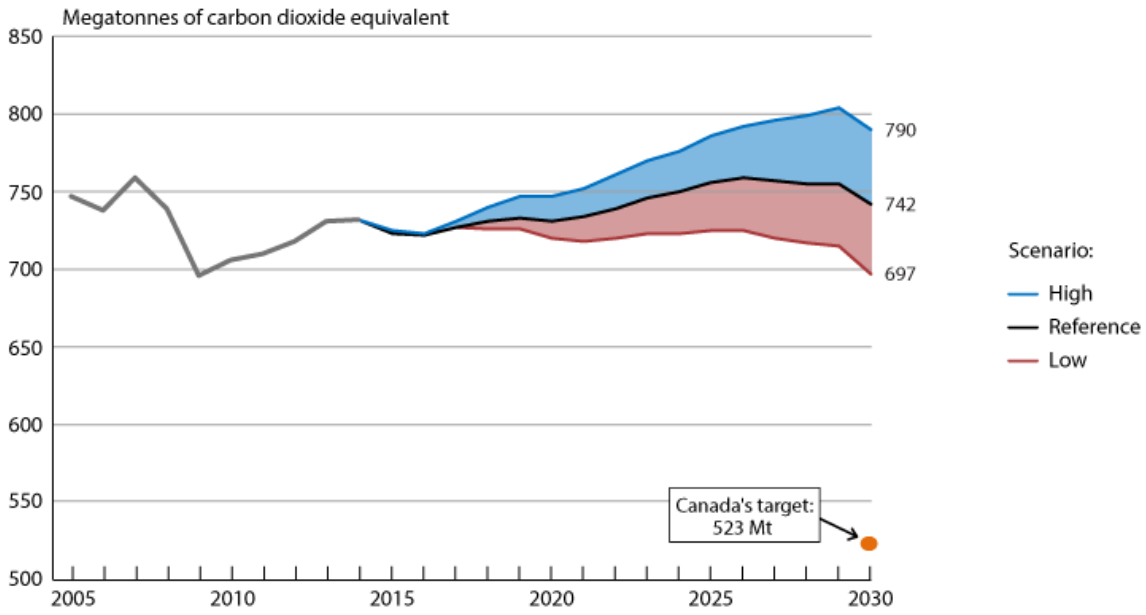


Source: Pemex, (2017)

Environmental Risks

A second issue in evaluating pipeline options is environmental risk. One important issue is the impact of oil pipelines and oil production on Canada's GHG emissions. Current forecasts show that Canada will not meet its GHG targets without new emission reduction policies (Figure 5). The most significant source of increased GHG emissions is the Canadian oil and gas sector (Canada, 2017), which accounts for the largest proportion of Canadian GHG emissions (25%) and the largest increase in GHG emissions (21% between 2014 and 2030). GHG emissions do not vary significantly among pipeline options but the aggregate impact of pipeline development and oil and gas expansion needs to be assessed by a cumulative impact assessment that determines the level of oil production and pipeline capacity that is consistent with Canada's climate change objectives. Canada has published a general framework for meeting its GHG objectives, but the framework provides a list of potential actions to reduce emissions without documenting the specific impacts of each proposed initiative and without providing a detailed implementation plan (Canada, 2016). Therefore, it is unclear whether it is possible for Canada to meet its 2030 target with the anticipated expansion in oil production.

Figure 5: Canada's Greenhouse Gas Emissions Forecast to 2030



Source: Canada, (2017).

Other environmental risks such as the impact of pipeline spills will vary depending on the location of the pipeline. A summary of the NEB's findings on the likelihood of adverse consequences from three of the proposed pipelines that it assessed show a significant difference in environmental risk (Table 5). The NEB concludes that the Enbridge Line 3 and Keystone XL pipelines are unlikely to have **any** significant adverse environmental effects while the TMEP is likely to have three significant adverse effects all resulting from marine tanker traffic. Likely adverse effects of the TMEP include: impacts on whales, Aboriginal culture and greenhouse gas emissions.

Another difference in environmental risk between the TMEP, Keystone XL, and the Enbridge Line 3, is the risk of tanker spills. The tanker traffic generated by the TMEP will generate a spill risk to the marine environment along BC's South Coast, which has been classified in the highest value, highest risk area in Canada (WSP, 2014). Trans Mountain estimates that there is a 77% chance of a marine terminal spill and between a 16% and 67% chance of a marine tanker spill over a 50 year operating period (Table 6). The variation depends on assumptions regarding the effectiveness of alternative spill risk mitigation measures. However, due to various methodological deficiencies, Trans Mountain lower bound estimate of 16% underestimates the likelihood. Other studies estimate that the likelihood of a marine tanker spill is between 58% and

98% (Table 6). The cost of a major tanker spill is estimated at between $5.8 and $25.5 billion (Gunton and Broadbent, 2015). Therefore a significant disadvantage of the TMEP relative to Keystone XL and Enbridge Line 3 is the risk of marine tanker spills.

Table 5: NEB Assessment of Adverse Effects of Pipelines

Project	**Likely Significant Adverse Environmental Effects**
TMEP	1. Southern resident killer whales 2. Aboriginal culture 3. Greenhouse gas emissions 4. *Marine oil spill risk**
Enbridge Line 3	No significant adverse effects
Keystone XL	No significant adverse effects

* Marine oil spill risk was identified by the NEB as having the potential to cause significant adverse effects but the risk of a spill occurring was deemed unlikely by the NEB. The NEB's conclusion that a spill is unlikely is contrary to the evidence on spill probability (see for example Gunton, 2016) and therefore marine oil spills are listed is this table as a likely significant adverse effect.

Source: NEB, (2009; 2016c; 2016d).

Table 6: Probabilities for TMEP Tanker, Terminal, or Pipeline Spills

Type of Spill	**Spill Probability over 50 Years**
Tanker Spill (TM estimate)	16 – 67%*
Tanker Spill (other estimates)	58-98%
Tanker Spill (mid-point estimate)	57%
Terminal Spill (TM estimate)	77%
Pipeline Spill (TM estimate)	99%
All Spills	99%

Source: Gunton and Broadbent, (2015) * There are a number of deficiencies in TM's oil spill risk analysis that mean that the lower end range of 16% significantly underestimates the likelihood of a spill and should not be relied on.

Costs

Another consideration in comparing pipeline projects is cost. There is currently insufficient information to accurately compare forecast shipment costs per barrel for all four proposed pipeline projects due to the uncertainty over project capital costs. For example, capital cost estimates for the TMEP have risen from $5.5 billion in the original application to the NEB (Trans Mountain, 2013, Vol. 2 App. B) to $7.4 billion as of March 2017 (Trans Mountain, 2017). Another factor complicating comparisons is the current status of the projects. The incremental costs of completing Keystone XL, for example, are lower than total project costs because Trans Canada has already spent about $4.3 billion on the project (TransCanada, 2015, p.54). Therefore there is a strong case for building Keystone XL because a larger proportion of the project has already been completed.

Although more detailed analysis is required to compare pipeline costs, the information in Table 7 indicates that the current cost of shipping to tidewater in the US Gulf on the Enbridge and Keystone pipeline systems are relatively close to the costs of shipping on TMEP to Asia. The competiveness of the pipeline options with each other is also confirmed by the decision of shippers to sign long term transportation contracts with the different pipeline developers. Therefore, it appears that no one pipeline option has a significant shipping cost advantage relative to the other and that TMEP has no cost advantage to offset its higher environmental risks relative to Enbridge Line 3 and Keystone XL.

Table 7: Comparison of Toll Rates to US Gulf and China

Transportation Option	**US $ per b.(Heavy Oil)**
TMEP (toll to Westridge + tanker to China, 20 year term)	$8.75
Enbridge (Hardisty to US Gulf, 15 year term)	$6.95
Keystone (Hardisty to US Gulf , 20 year term)	**$7.**80

Source: TMEP estimates are based on tolls rates from TM (2013, App. 4, p. B1) adjusted to reflect the recent capital cost increase to $7.4 billion and converted to US dollars. Tanker rates are from Muse Stancil (2015, p 62); Enbridge and Keystone tolls are from CAPP (2016, p. 42).

Government Decision

On November 29, 2016, the federal government announced its decision to approve the TMEP. This decision was based on outdated market information that did not accurately reflect current market conditions and options and insufficient information. Key information gaps and questions identified by the Government of Canada's Ministerial Panel on TMEP (Canada. MP, 2016) that should have been addressed prior to the government's approval of the TMEP include:

- How can Canada meet its climate change commitments while approving the project?
- How can the project be evaluated in the absence of a comprehensive energy policy and consideration of other viable transportation and energy options?
- What is the best route and design to protect environmental values?
- Given changed circumstances and flaws in the NEB process, how can a decision be made without adequate assessment of the risks and benefits?
- How can approval be reconciled with Canada's obligations to First Nations and free, prior and informed consent?
- How can the project meet the requirements of social license, given the strong public opposition?

Conclusions

This report assesses the demand and supply of WCSB transportation services in light of recent market developments including downward adjustments in oil price and production forecasts and re-emergence of alternatives to TMEP such as Keystone XL. Three alternative supply and demand scenarios for WCSB oil are developed: a higher growth scenario with no rail; a higher growth scenario with rail, and; a lower growth scenario without rail. The conclusions are as follows:

1. Under the lower growth oil supply scenario no major new pipelines and no rail transport are required during the forecast period to 2030 other than the completion of the Enbridge Line 3 Replacement. Construction of additional proposed pipeline projects (TMEP, Energy East, Keystone XL) is not required and would result in 2.7 million bpd of excess pipeline capacity in 2025.
2. Under the higher growth oil supply scenario with some rail shipments, no major new pipelines are required during the forecast period until 2030 other than the completion of the Enbridge Line 3 Replacement. Construction of additional proposed pipeline projects (TMEP,

Energy East, or Keystone XL) is not required and would result in 3.0 million bpd of excess pipeline capacity in 2025.

3. Under the higher growth oil supply scenario with no rail shipments, no major new pipelines are required until 2023 other than the completion of the Enbridge Line 3 Replacement. In 2023 only one of the additional new pipelines (TMEP, Energy East, or Keystone XL) will be required. Construction of the additional proposed pipeline projects is not required and would result in 2.4 million bpd of surplus pipeline capacity in 2025.
4. Shipper contracts are cited by the project developers as evidence that the pipeline projects are needed. However, these contracts were signed before the downturn in oil markets and therefore do not reflect current market conditions.
5. The existence of shippers' contracts provides the financial incentive for TMEP to be built even if it is not needed because shippers would be legally required to pay the tolls regardless of whether they used the TMEP. Oil producers would divert shipments from existing transportation facilities (eg. Enbridge pipelines) that do not have contracts to meet their TMEP contracts. The costs of the empty space would be borne by other shippers and Canadian governments in the form of reduced tax revenue.
6. Given the fact that more pipeline projects are proposed than required under all scenarios, it is important to complete a comprehensive comparative benefit cost assessment that evaluates all proposed projects from a social, economic, and environmental perspective to determine which project or mix of projects are required and best meet Canada's public interest. This evaluation should also specify the level of oil production and pipeline expansion that is consistent with Canada meeting its climate change commitments and answer all six questions posed by the Ministerial Panel on the TMEP.
7. An important factor in assessing the merits of alternative pipeline proposals is their environmental impact. A major environmental disadvantage of TMEP relative to Keystone XL and the Enbridge Line 3 Replacement is that TMEP requires tanker traffic that will create significant adverse environmental effects on whales, Aboriginal culture and greenhouse gas emissions in BC. TMEP also results in a significant risk of marine tanker oil spills. Keystone XL and Enbridge Line 3 expansion involve no tanker spill risk.
8. The alleged advantages of the TMEP of market diversification and higher prices are minimal to nil compared to other new pipeline options. Pipelines to the US can achieve similar economic benefits as TMEP by shipping to tidewater locations in the US Gulf and receiving world market prices with fewer environmental risks.

9. **The key findings of this report are**:

    a. Recent developments in oil markets, climate change policies, and the US approval of Keystone XL have undermined the rationale for building the TMEP because there are alternatives to the TMEP that can achieve similar economic benefits no environmental risks to Canada's and BC's marine environment from oil tanker traffic.
    b. The decision of the federal government to approve the TMEP was based on outdated information that did not reflect current oil market conditions and a deficient evaluation process that did not provide the necessary information to make a public interest decision.
    c. The decision to approve both the TMEP and Enbridge Line 3 along with the US approval of Keystone XL could result in the construction of approximately $25 billion of excess pipeline capacity. This excess pipeline capacity will impose a significant cost on the oil sector in higher tolls and on Canadian taxpayers in the form of reduced tax revenue from the oil industry.
    d. Given the significant change in oil markets and transportation options, the federal government should:
        i. Publish a climate change strategy that identifies how Canada will meet its climate change targets to reduce GHG emissions by 30% by 2030 and what level of Canadian oil production is consistent with this plan.
        ii. Complete a comprehensive evaluation of oil transportation options and identify the options that best meet Canada's public interest from an economic, social and environmental perspective and ensure that only those projects that are required and in Canada's public interest are built.

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