Department of Energy
Washington, DC 20585

February 2, 2015

MEMORANDUM FOR AMBASSADOR JOSEPH MACMANUS

FROM: ERICA DE VOS
DEPUTY CHIEF OF STAFF AND
DIRECTOR, OFFICE OF THE EXECUTIVE SECRETARIAT

SUBJECT: DEPARTMENT OF ENERGY COMMENTS

In response to your memorandum of January 16, 2015, re: the *Application for Presidential Permit by TransCanada Keystone Pipeline L.P. to Construct, Connect, Operate, and Maintain Pipeline Facilities on the Border of Canada and the United States*, attached please find the Department of Energy's comments.

If you have questions or need additional information, I can be reached at (202) 586-9712 or erica.devos@hq.doe.gov.

DOE Comments related to the National Interest Determination of Keystone XL

The Department of Energy offers the following comments related to the National Interest Determination for the construction of the Keystone XL pipeline.

1. Global oil markets, US oil supply

The United States is in the midst of a boom in the production of oil. This boom, in conjunction with changing global demand and increased global capacity, has significantly altered market conditions – even in the short time since the Final Supplemental Environmental Impact Assessment (FSEIS) was prepared by the State Department in early 2014. This is graphically illustrated in Figure 1 below, which shows the sharp decline in prices of both Brent and West Texas Intermediate (WTI) since last year. These and other market changes may provide some additional context for consideration of the national interest determination for the Keystone pipeline.

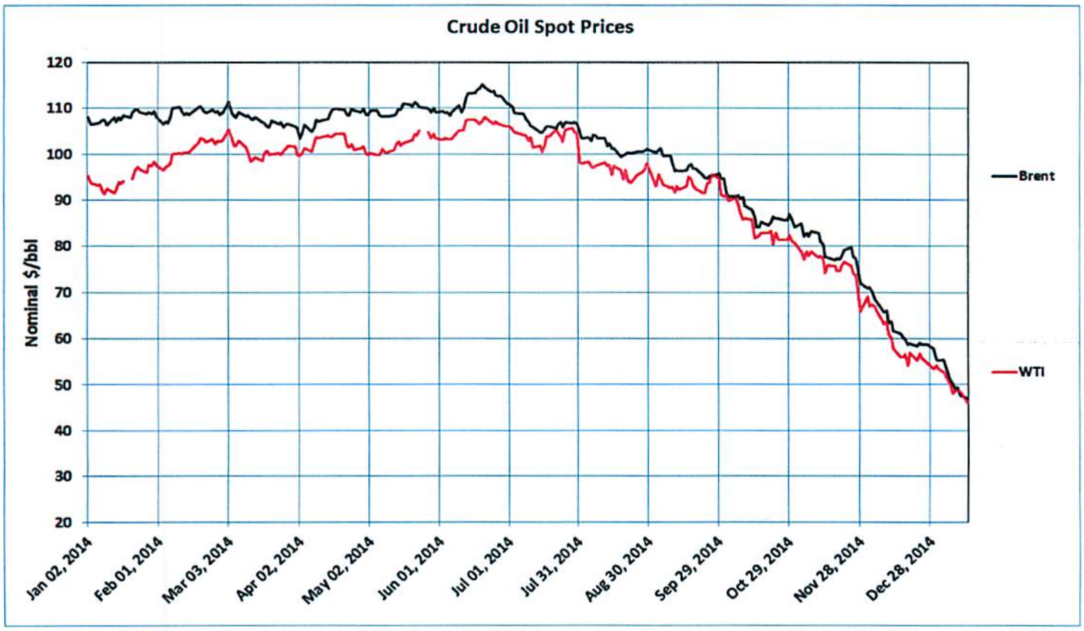

Figure 1. Brent and WTI oil prices, January – December 2014.

One of the most significant contributors to this change in global prices was the rapid increase in North American oil production. Since 2008, US oil production has climbed to over 9 million barrels/day (MMbbl/day) due to tight oil plays in North Dakota, Texas and elsewhere[1]. This is an increase of approximately 4 MM bbl/day since 2008[2]. According to the EIA, the US is the largest producer of hydrocarbons (combined petroleum and natural gas) in the world, surpassing Saudi Arabia and Russia[3]. Canada too has seen a rapid growth in its liquid fuels production, producing more than 4 MMbbl/day of

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[1] EIA, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M

[2] EIA, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M At the beginning of 2008, US production totaled 5,111 MM bbl/day. As of November 2014, the monthly total was 9, 020 MM bbl/day.

[3] EIA, http://www.eia.gov/todayinenergy/detail.cfm?id=13251

oil and other liquids in 2013 – an increase of nearly a million barrels/day from a decade ago[4]. Along with increased US production has come a decrease in imports: in 2005 net imports of crude oil and petroleum products averaged 12.5 MMbbl/day; in October 2014, net imports of crude and product had declined to 4.8 MMbbl/day and of this, only 38 percent was from outside the Americas[5]. Coincident with this increase in oil availability has been a decline – projected to continue through 2040 – of demand, particularly for motor gasoline[6].

The US and Canada have the largest bilateral energy trading relationship in the world. It includes an extensive network of cross-border pipelines (see figure 2), an interconnected rail network (see figure 3) and an array of inland lake and waterway systems through the Great Lakes and St Lawrence River. More than 95% of all Canadian liquid fuel exports are shipped to the US market[7].

Figure 2. Canada-US Pipelines – Source: http://www.theodora.com/pipelines/canada_pipelines.html

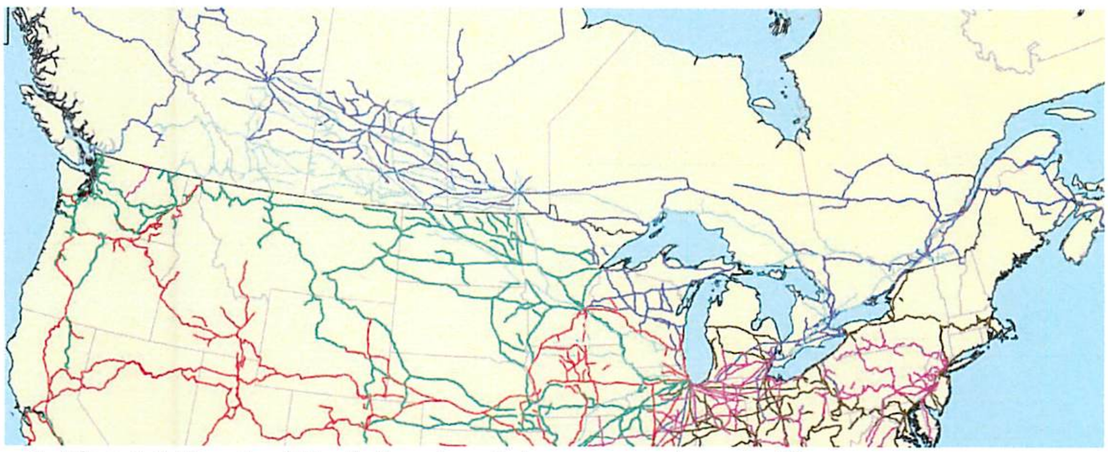

Figure 3. Class 1 Railroads of North America. Colors represent ownership.
Source, *http://www.acwr.com/economic-development/rail-maps*

[4] EIA, http://www.eia.gov/countries/country-data.cfm?fips=ca
[5] EIA, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MTTNTUS2&f=A
[6] IEA. http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014ER&subject=15-AEO2014ER&table=7-AEO2014ER&region=0-0&cases=full2013-d102312a,ref2014er-d102413a
[7] Data derived from the Canadian Energy Board at https://www.neb-one.gc.ca/nrg/sttstc/crdlndptrlmprdct/stt/stmtdcndncrdlxprttpdstn-eng.html

2. Climate change, the extraction of oil, and the transportation sector

Not all oil is of the same GHG intensity, as is made clear in the analysis in the State Department's Final Supplemental Environmental Impacts Assessment (FSEIS, 2014):

> *"The total annual lifecycle emissions associated with production, refining, and combustion of 830,000 barrels per day (bpd) of oil sands crude oil transported through the proposed Project, as determined through this assessment, are approximately 147 to 168 MMTCO2e. The equivalent annual lifecycle GHG emissions from 830,000 bpd of the four reference crudes (representing crude oils currently refined in Gulf Coast area) examined in this section are estimated to be 124 to 159 MMTCO2e. The range of incremental GHG emissions (i.e., the amount by which the emissions would be greater than the reference crudes) for crude oil that would be transported by the proposed Project is estimated to be 1.3 to 27.4 MMTCO2e annually. Because the estimates of lifecycle emissions from oil sands (i.e., 147 to 168 MMTCO2e) and the four reference crudes (i.e., 124 to 159 MMTCO2e) both represent ranges across various studies, it is not possible to subtract the high and low bounds from each to arrive at the net emissions result. Instead, the results for oil sands crudes from one study need to be consistently compared against the results for the other reference crudes from the same study to produce the final net emissions result (i.e., 1.3 to 27.4 MMTCO2e)[8].*

Thus, the report makes clear that there is an increase in the GHG emissions associated with the oil sands extraction as compared to the "reference barrel" of oil extracted in or imported to the US currently[9]. The "reference barrel" was calculated on the basis of a composite of the average US barrel consumed in 2005, Venezuelan and Mexican (Maya) heavy oil, and Saudi light oil; the relative share of these has since changed in the US market.

The Intergovernmental Panel on Climate Change (IPCC) notes that 14% of global greenhouse gas emissions come from the transport sector[10] which is powered almost exclusively by oil, and in the US the transport sector share is much higher at 28%[11]. The IPCC notes that the policies and technologies required to reduce emissions from the transportation sector are largely related to the development and penetration of new, low emission transport technologies[12]. These include more efficient light and heavy duty vehicles, the electrification of the vehicle fleet (especially as the electricity sector is decarbonized), the use of biofuels and modal shifting. In the US, CAFE standards drive efficiency, and there are incentives for biofuels and electric vehicles. Current DOE programs are designed to address these emissions. These programs include efforts to increase the energy efficiency of fuels through more efficient engine technologies, more aerodynamic design and the use of lighter weight materials. DOE is

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[8] US Department of State, Final Supplemental Environmental Impact Assessment, 2014, p 4.14-4-4.14-5; at http://keystonepipeline-xl.state.gov/finalseis/

[9] In a 2014 report by the Congressional Research Service, it was noted that there are other crudes imported into the US with comparable CO2 intensities: "Compared to selected energy- and resource-intensive crudes, Well-to-Wheels GHG emissions from gasoline produced from a weighted average of Canadian oil sands crudes are found to be "within range" of those produced from heavier crudes such as Venezuelan Bachaquero and Californian Kern River, as well as lighter crudes that are produced from operations that flare associated gas (e.g., Nigerian Bonny Light)." See CRS, https://www.fas.org/sgp/crs/misc/R42537.pdf

[10] IPCC Working Group III, 5th Assessment Report, 2014. http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf

[11] EPA, National GHG Emissions Data. http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

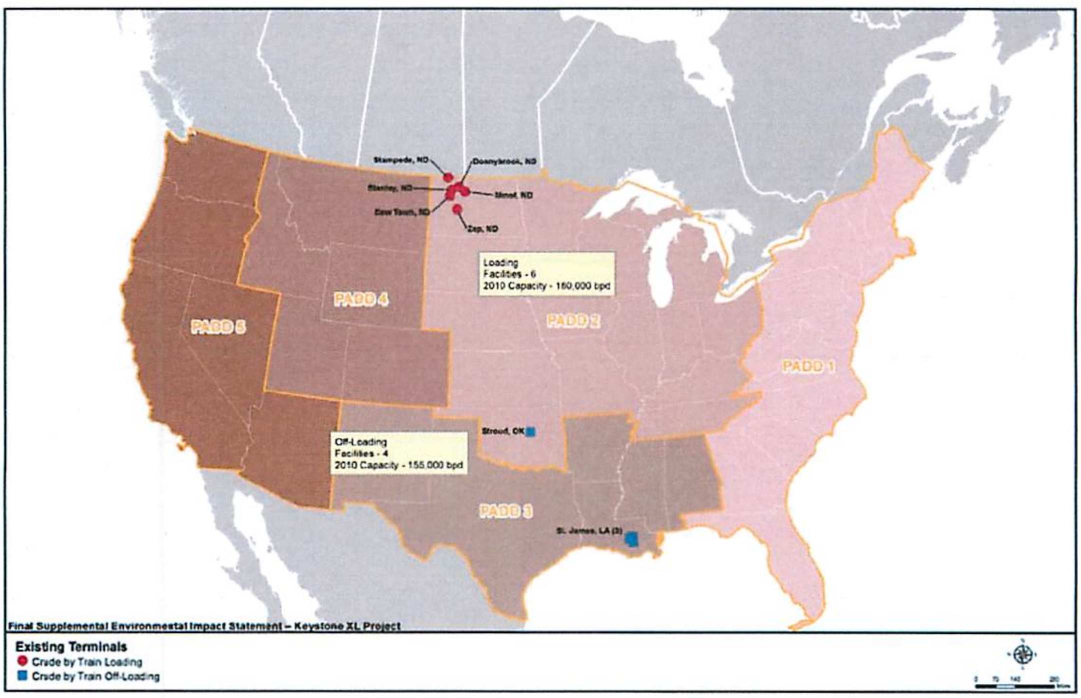
[12] IPCC, 5th Assessment Report, Working Group III, Chapter 8. At http://mitigation2014.org/report/publication

also investing in large programs to enable the transition to electric and fuel-cell vehicles that utilize potentially lower carbon fuel sources such as electricity and hydrogen.

Given price elasticities in the transportation sector and the predominance of internal combustion engine vehicles on the road today, small changes in oil price do not significantly alter driving behavior or technology penetration rates. Hence, even if there were a small price increase associated with the incremental costs of shipping oil by rail, they are not likely to drive down CO2 in the sector. Furthermore, the EIA has demonstrated that US retail prices for gasoline are correlated with the international Brent benchmark price, not the cost of domestically produced crude oil to US refineries[13].

3. Impacts of Keystone

As noted above, there are incremental GHG emissions associated with the extraction of the oil sands of Alberta versus those produced in other fields. In support of its analysis for the Final Supplemental Environmental Impact Assessment, the State Department developed several scenarios to assess the impact of constraints on pipeline build-out. These included scenarios constraining cross-border lines, constraining lines within Canada (to the East and West coasts) and constraints on building any new lines at all. Even in the case where no new pipelines were built, oil can reach refineries by rail (the total volume of the pipeline could be accommodated by approximately 14 daily 'unit' trains, each of 100 cars). In combination with the already extensive existing rail network (see figure 3 above) a very rapid increase in the loading and offloading capacity to move oil by rail has been observed (see figure 4 below from the FSEIS); many of these new facilities are capable of handling unit trains. Based on its analysis of the data on transport alternatives, the FSEIS suggested that any decision on this pipeline would have a limited impact on the production of the oil fields.



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[13] EIA 2014. http://www.eia.gov/todayinenergy/detail.cfm?id=18651

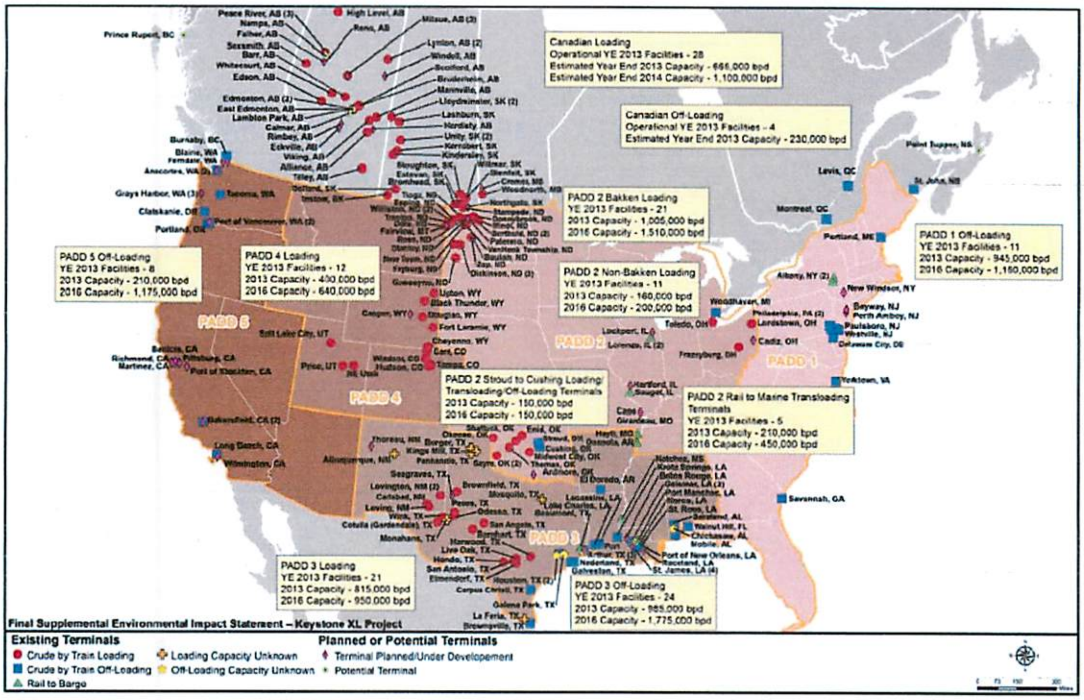

Figure 4. Crude by Train Loading and Off-Loading Facilities in 2010 (top map) and 2013 (bottom map). *Source: Final Supplemental Environmental Impact Assessment, 2014, p 1.4-5.* http://keystonepipeline-xl.state.gov/documents/organization/221147.pdf

The analysis was undertaken at a time when oil prices were quite high – more than $100/bbl. In light of the decline in oil prices (see figure 1 above), the issue may be more complicated. The FSEIS analysis was predicated on the assumption that without additional pipeline capacity, there would continue to be a cost differential between oil produced in Canada and that produced in the US or in other parts of the world. The FSEIS further calculated that the cost differential in shipping by rail vs shipping by pipe was as much as $8/bbl. With high oil prices, this increment in shipping costs would not eliminate profit margins. However, with sustained lower oil prices, margins could be squeezed to the point of unprofitability and additional expansion or greenfield projects could potentially be shut in.

The FSEIS did undertake an analysis of what would happen with low oil prices – using a level of $65-$75/bbl as a threshold. Under their analysis, indeed, production would be expected to decline. The FSEIS phrased it as follows:

> *"Above approximately $75 per barrel (West Texas Intermediate [WTI]-equivalent), revenues to oil sands producers are likely to remain above the long-run supply costs of most projects responsible for expected levels of oil sands production growth. Transport penalties could reduce the returns to producers and, as with any increase in supply costs, potentially affect investment decisions about individual projects on the margins. However, at these prices, enough relatively low-cost in situ projects are under development that baseline production projections would likely be met even with constraints on new pipeline capacity. Oil sands production is expected to be most sensitive to increased transport costs in a range of prices around $65 to 75 per*

barrel. Assuming prices fell in this range, higher transportation costs could have a substantial impact on oil sands production levels—possibly in excess of the capacity of the proposed Project—because many in situ projects are estimated to break even around these levels. Prices below this range would challenge the supply costs of many projects, regardless of pipeline constraints, but higher transport costs could further curtail production."

Present day oil prices have fallen well below this $65-$75 threshold. Following the logic of the FSEIS, it could be expected that we would see a curtailed level of production (though such a decline may only manifest if low prices are sustained).

Three confounding factors may prevent this outcome from materializing. First, it is anticipated (according to the EIA's Short term Energy Outlook), that oil prices are likely to rise over the course of this year and next (with Brent averaging around $58/bbl in 2015 year, and rising to an average of $75/bbl in 2016, and WTI prices expected to be $3-$4/bbl below Brent)[14]. The range is much wider: The 95% confidence interval for market expectations widens considerably over time, with lower and upper limits of $28 and $112 for prices in December 2015[15]. The uncertainty in price allows for scenarios in which impacts are commensurately uncertain. In evaluating this, it is important to note that most large scale projects are built with multi-year investments and returns, and most energy economists agree with the EIA that oil prices will climb on average over the next years. Although the market drivers were different, a similar pattern was seen after the precipitous oil price decline during the "great recession" of 2008-2009.

Second, the FSEIS was undertaken using 2013 (or earlier) cost data which indicated that production costs in both in situ and mining operations ranged from approximately $50/bbl to more than $80/bbl. Recent data from Wood Mackenzie[16] suggests that the actual costs in Canada may be lower – and that it is only with prices at or below $40/bbl that significant effects would be felt:

- At $50/bbl for Brent, only 190,000 b/d of oil production is cash negative, representing 0.2% of global supply. Seventeen countries supply oil that is cash negative at $50, with the main contributors being the United Kingdom and the United States.
- At $45/bbl, 400,000 b/d is cash negative, or 0.4% of global supply. Half of this production is from conventional onshore production in the US.
- At $40/bbl, 1.5 million b/d is cash negative, or 1.6% of global supply. At this point, **the biggest contribution is from several oil sands projects in Canada**. Tight oil production only starts to become cash negative as the Brent oil price falls into the high $30's. (*emphasis added*)

Using this analysis, the price would need to fall further (and remain low) before any incremental costs of shipping by rail would begin to affect production. Here too, however, the analysis is complicated: there is a considerable range of production costs within the oil sands, and for some fields, even with sustained prices at today's levels, the cost differential could mean unprofitable operations and consequent slowed

[14] EIA, Short Term Energy Outlook, January 2015. http://www.eia.gov/forecasts/steo/
[15] ibid
[16] Wood Mackenzie, January 2015. "When would low oil prices halt production" http://public.woodmac.com/public/views/low-oil-prices-halt-production

production. Some slow-down has already been seen in a reduction in new exploratory projects and the limited expansion of Canadian oil sand development. The Canadian Association of Petroleum Producers estimates that, as a result of the new low oil prices, there has been a decline in short term capital spending in Western Canada of about 33%; oil sands investments for 2015 are projected to total $46 billion in 2015, down from $69 billion invested in 2014. They consequently project a slowdown in the growth of oil production from their prior forecast of about 65,000 barrels per day in 2015 and 120,000 barrels per day in 2016[17]. Notwithstanding the slowdown, oil sands production remains fairly constant as existing projects with firm contracts continue to come on line; CAPP projects that production will be only slightly down through 2016, growing from 3.5 to 3.8 MMb/d instead of 3.9 MMb/d[18]. An important point here is that in situ oil production has a lower decline rate than tight oil as it requires fewer wells to maintain production. How much more this would be curtailed by the price differential between pipeline and rail is not clear.

A third factor further confounds the analysis: the price differential between pipeline and rail seems to be declining since the report was produced. Considerable incremental capacity – including both new loading and unloading facilities as well as additional rolling stock and track – have been brought on line since the report was drafted. This capacity represents a sunk cost, and enables future rail-based oil transport without additional capital investment. These realities should put downward pressure on the cost of rail transport. Further, some value accrues to the producer selling by rail; they can choose the markets with the highest value for their product based on rapidly changing supply and demand rather than be constrained to the end-point for a pipeline. These factors may have reduced the relative costs of rail versus pipelines in determining profitability.

On the issue of energy security, recent analyses, including those undertaken for the Quadrennial Energy Review, suggest that US infrastructure is facing a number of issues, including those related to supply interruptions and the adequacy of delivery capacity from the Strategic Petroleum Reserve as well as refined product capacity. Keystone will not appreciably change the current constraints of the US refinery system or the distribution of refined product (which increasingly relies on access to heavy crude). The security of the supply side – with a large portion of Canadian crude expected to flow to the US either by rail (as it is doing now), by barge, or even from coastal Canadian terminals supplied by Canadian pipelines that then supply US refineries through tanker – are all likely to continue. If Canada decides not to move the oil to the US, but rather to export it to the global market through new Canadian port facilities, that will result in additional supply in the global system – essentially adding to US security, even if more indirectly. However, as noted earlier, significant benefits could accrue to US (and global) energy security through policies and programs to reduce transport-related oil use. In this context, we note that the collective energy security principles outlined by the G-7 leaders and energy ministers in 2014 included two especially relevant provisions: first, "reducing our greenhouse gas emissions and accelerating the transition to a low carbon economy [are] key contributors to enduring energy security,"

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[17] Canadian Association of Oil Producers, CAPP, January 21 2015. http://www.capp.ca/aboutUs/mediaCentre/NewsReleases/Pages/access-to-markets-remains-critical.aspx

[18] ibid

and; second, "energy efficiency in demand and supply should be enhanced [to increase collective energy security][19]."

There are several economic issues to consider. Among them is whether construction of the pipeline would impact rail shipping prices for oil and other commodities. Shipping prices for commodities ranging from grain to coal have increased. However, as discussed earlier, there has been incremental rail capacity added since the FSEIS was drafted. It appears that the market will seek to find the most competitive options. Second regarding refinery costs, it is clear that Canadian oil faces a significant discount relative to other sources of crude because of the cost of transport. As long as such discounts hold, the Canadian producers absorb the price differential. If the cost of transport was reduced as a result of increased transport capacity, it is uncertain whether Canadian producers would pass along the cost reductions to refiners or would simply reduce price discounts. Finally, with respect to the operational benefits of the pipeline, the FSEIS projects several thousand new jobs associated with pipeline construction, but notes that these would be of relatively short duration (1-2 years); approximately 50 jobs would be generated in pipeline operations[20].

In addition to the GHG emissions (noted earlier), other environmental issues are worth noting. For example, the State Department's FSEIS notes that both the total quantity of oil released in pipeline leaks is significantly larger than that released in rail accidents (largely as a consequence of the volume of throughput), and pipeline leaks are more significant on the basis of barrels released per total barrels transported; this is clear in figure 5.

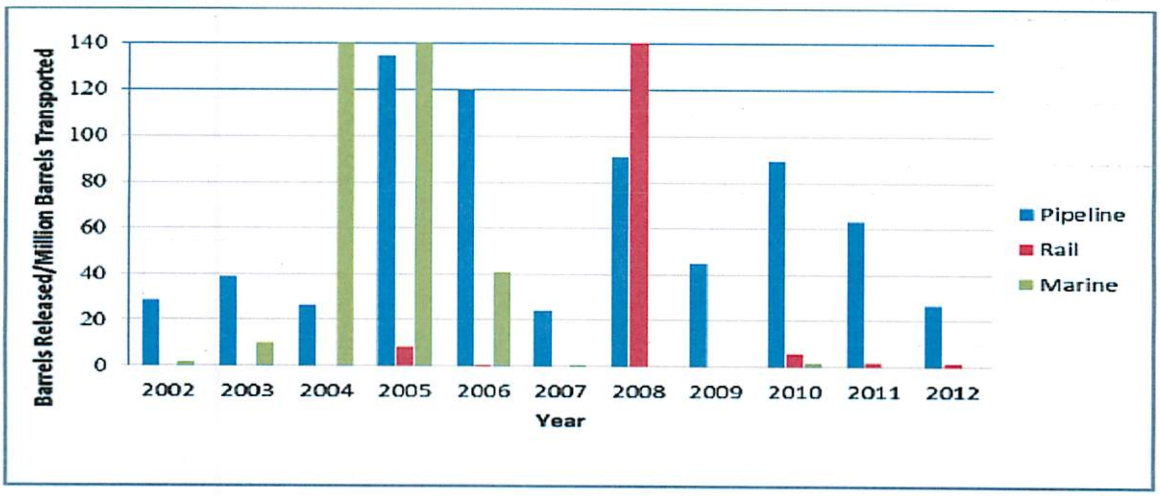

Figure 5. Number of Barrels Released per Million Barrels Transported, Crude Oil: Pipeline, Rail, and Marine. *Notes: The highest reported value is the 2004 marine value (1,088 barrels per million transported). The rail 2002 barrels transported data are not available. Source: U.S. Department of State. Final Supplemental Environmental Impact Statement, Keystone XL Project.*

Conversely, as shown in Figure 6 (also from the FSEIS), the safety record favors pipelines over rail. Pipelines have had practically no fatalities, while on an annual basis, the rail activities required to move

[19] The full G7 joint statement of the Rome Energy Ministerial can be found at: http://europa.eu/rapid/press-release_IP-14-530_en.htm

[20] FSEIS, Executive Summary, p ES-19.

a quantity of oil equivalent to that moved by Keystone could increase injuries (according to the FSEIS, adding 830,000 bpd to the yearly transport mode volume would result in an estimated 49 additional injuries and six additional fatalities if the transport were by rail, while adding only one additional injury and no fatalities for the proposed Project on an annual basis[21].)

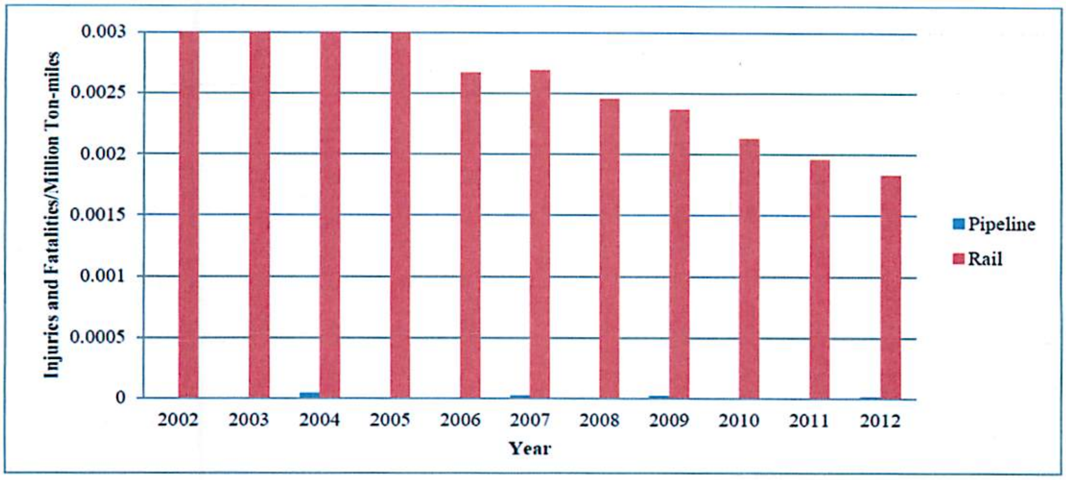

Figure 6. Number of Injuries and Fatalities per Million Ton-Miles Transported: Petroleum Pipeline and Class I Rail. *Notes: The vertical axis (injuries and fatalities per million ton-miles) was adjusted to show the lower reported values. The highest report value is the 2002 rail value (0.00335 injuries and fatalities per million ton-miles). Pipeline ton-miles are for all petroleum products. Frequencies for pipelines are reported based on available data from 2002-2009. Source: U.S. Department of State, FSEIS.*

<u>Summary</u>

The following points seem relevant as a decision is taken on this matter:

- Market conditions have changed since the FSEIS was written; oil prices have declined considerably and the boom in US production has continued;
- The FSEIS evaluated the impact under a low oil price scenario and concluded that oil sands production would be expected to show sensitivity to a sustained price below $65-$75 per barrel. Prices are now well below this level but there are additional recent developments that could minimize the effects of this price:
    - Oil sand production may now be less expensive than modeled;
    - Projects in the oil sands are longer term capital investments. Most analysts expect a price rebound within the next year or two (although according to the EIA, there is considerable uncertainty around such projections);
    - The rail/pipeline price differential may have narrowed though it is still present.
- The US and Canada, allies and neighbors, have the largest bilateral energy trading relationship in the world; Canada is our largest supplier of petroleum.

[21] State Department, FSEIS, Executive Summary , P. ES-35.

We also note that the decline in global oil prices has reduced new investment in the Canadian fields.

- A significant increase has been seen in the volume of crude-by-rail shipments (anticipated but not fully realized when the FSEIS was drafted);
- The oil produced in the Canadian sands has a higher level of emissions than a "reference" barrel; for a pipeline flow of 830,000 barrels/year, the incremental GHG emissions would range from 1.3 to 27.4 MMTCO2e annually, depending on the scenario.
- Environmental and safety analyses indicate pipelines have more total leakage than rail, but rail has a poorer safety record.