This paper is from course-related work undertaken by students in the University of Alberta School of Business. It is available on our website as evidence of the quality of our students and of their work.

This paper represent the opinions and views of the authors and not that of CABREE or the University of Alberta School of Business.
Alberta’s Oil Sands and US Refineries

Robert Huston
# Table of Contents

Table of Contents................................................................................................................... i
Table of Figures ........................................................................................................................ ii
Introduction............................................................................................................................... 1
Alberta....................................................................................................................................... 2
  Scale of Deposits..................................................................................................................... 3
  Export Levels to the US........................................................................................................... 5
  Local refineries and upgraders............................................................................................... 9
The United States..................................................................................................................... 10
  US PADs ............................................................................................................................... 15
  Base oils, sources, and refineries ......................................................................................... 18
  Potential switchover costs.................................................................................................... 22
Transportation........................................................................................................................... 29
Other alternatives.................................................................................................................... 31
  Alternative markets for Canadian exports ........................................................................ 31
  Alternative sources for American imports ......................................................................... 33
Conclusions............................................................................................................................... 36
References................................................................................................................................. 37
# Table of Figures

- Figure 1 Hydrocarbon Resources in Alberta ................................................................. 2
- Figure 2 Proven World Reserves of Crude Oil ................................................................. 4
- Figure 3 Canadian Oil Production and Consumption ...................................................... 5
- Figure 4 Canada’s Oil Exports to the US ........................................................................ 6
- Figure 5 Canadian Bitumen Production .......................................................................... 7
- Figure 6 Western Canadian Oil Production by Source ..................................................... 8
- Figure 7 Western Canadian Oil Production by Commodity ............................................. 8
- Figure 8 Global Oil Consumption ................................................................................... 12
- Figure 9 US Petroleum Consumption by Region .............................................................. 13
- Figure 10 Gross US Oil Imports ..................................................................................... 14
- Figure 11 PADDs ............................................................................................................. 15
- Figure 12 Canadian Crude Disposition (2002) ................................................................. 17
- Figure 13 Current and Potential Crude Oil Markets in the US ......................................... 18
- Figure 14 US Refining Capacity by PADD ..................................................................... 20
- Figure 14 US Oil Imports by Region ................................................................................. 21
- Figure 16 Refinery Demand by Market ......................................................................... 22
- Figure 17 Gulf Coast Refinery Demand ....................................................................... 24
- Figure 18 An Acceptable Mix? ......................................................................................... 25
- Figure 19 Venezuelan oil production and exports to the US ........................................... 25
- Figure 20 A Problem with the US Refining Industry? ...................................................... 27
- Figure 21 Existing Major Pipeline Capacity ................................................................... 29
- Figure 22 Expected Netbacks of Pipeline Alternatives .................................................... 30
- Figure 23 Estimated Costs of Pipeline Options ............................................................... 30
- Figure 24 Trend of Chinese Oil Demand ......................................................................... 31
- Figure 25 Demand Statistics for China’s Oil Consumption ............................................. 32
- Figure 26 World Oil Flows .............................................................................................. 35
Introduction

The increasing development of the oil sands in Northern Alberta represents a large potential influence in Canada, the United States, and potentially in a number of other countries/regions. Alberta is a province which has been blessed with a wide variety of hydrocarbon resources. Due to the continuing depletion of conventional resources around the world, there has been a steady increase in interest regarding the development of unconventional sources. These unconventional sources were often not developed in the past due to higher associated costs, lower world oil prices, and the abundance of conventional reserves. But due to the decreasing conventional reserves, and political and security considerations, the development of the oil sands is now a topic of intense interest among different groups.

Due to the scale of the reserves, and the expected production life of many projects, there is the potential for production from the oil sands to have an impact on the refining industry in Canada, the US, and elsewhere. These impacts may take a number of forms, and there is still uncertainty regarding many issues in which would have to be considered before there were any significant changes to the status quo.

But this topic is still of interest based on the potential impacts which exist. For this reason, an examination of a number of the facets of the situation would appear to be in order, both in background, and in alternate scenarios.
Alberta

Oil and gas is a critically important resource in Alberta for a variety of reasons. Alberta is the most significant province in the Canadian oil and gas industry. The province produces roughly 70% of the oil in Canada, and around 80% of the natural gas. 75% of total industry spending is done in the province as well. Revenue from oil and gas generates roughly one third of the Alberta government’s total revenues. Oil and gas are also the most significant exports from the province. Exports of these commodities

---

account for 60% of Alberta’s total exports (intra-Canadian, and extra-Canadian).\textsuperscript{5} The revenue of the Alberta oil and gas industry (with by-products) was estimated at $57 billion in 2003.\textsuperscript{6}

In 2003 over $20 billion in capital expenditures were made in Alberta’s oil and gas industry.\textsuperscript{7} This number is bound to increase due to the increased investment in the oil sands. Billions of dollars in projects are planned in this vast resource, and this will greatly influence the provincial economy, as well as local economies. Direct and indirect employment linked to the oil and gas industry was stated as 275,000 jobs in 2003.\textsuperscript{8} This is a significant portion of the total workforce of the province linked to this industry.

So questions regarding the development of these resources, and impacts which may occur due to changes within the operating structure will be highly important to the province and people of Alberta. The expected increase in production from the oil sands is, therefore, an issue which will be of great interest to the province. And the potential markets for this production will also be of concern for them.

\section*{Scale of Deposits}

There is an estimated 1.6 trillion barrels of oil in place in the Alberta oil sands. According to estimates from the Alberta Energy and Utilities Board, roughly 174 billion barrels are currently economically recoverable.\textsuperscript{9} Many of the figures associated with the oil sands are subject to debate and reinterpretation. The EUB has also estimated that

\textsuperscript{5} \url{www.capp.ca/default.asp?V_DOC_ID=675}, April 10, 2005.
\textsuperscript{7} \url{www.capp.ca/default.asp?V_DOC_ID=675}, April 10, 2005.
\textsuperscript{8} \url{www.capp.ca/default.asp?V_DOC_ID=675}, April 10, 2005.
there is as much as 2.5 trillion barrels of bitumen in place, and that the total ultimate recoverable volume will be in the region of 315 billion barrels of bitumen.\textsuperscript{10}

Such a scale of reserves pushes the Canadian totals into second place behind Saudi Arabia in terms of overall crude reserves. With improvements in recovery technologies, it is possible that Canada will at some point have the largest recognized crude oil reserves in the world. The current number of recoverable barrels is only slightly over 10\% of the original oil in place. If new technologies changed so that roughly 20\% of the original oil in place was thought to be recoverable, this would give Canada reserves on the order of 350 billion barrels. It should also be noted that the Faja del Orinoco deposits in Venezuela could also benefit from improved recovery techniques developed in the Alberta oil sands. This would increase the recoverable oil from those deposits (estimated at around 2 trillion barrels of heavy oil in place\textsuperscript{11}).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Proven World Reserves of Crude Oil\textsuperscript{12}}
\end{figure}

\begin{thebibliography}{9}
\bibitem{12} www.energy.gov.ab.ca/docs/oilsands/ pdfs/osgenbrf.pdf, April 9, 2005.
\end{thebibliography}
Export Levels to the US

Canada and the US are major trading partners, and they have a very interconnected energy market. Over 99% of all Canadian oil exports head to the US, and Canada is one of the major sources for American oil imports. The total volume of exports to the US market has been increasing since the 1980’s. Daily exports to the US now exceed 1 million barrels a day, currently hovering around 1.6 million barrels a day.

Figure 3 Canadian Oil Production and Consumption

Source: EIA

Figure 3 Canadian Oil Production and Consumption

Of the oil produced in Canada, bitumen production is the area with the highest potential for growth. The advent of new technologies for in situ recovery, and expanded mining operations in the Ft. McMurray area will increase the amount of bitumen produced in Alberta. Current bitumen production already exceeds 1 million barrels a day. And the expectation is that this number will exceed 2 million barrels a day by 2015. This level of production would mean that the oil sands would be contributing two thirds of the daily oil output in Western Canada, which is expected to have daily output of around 3 million barrels a day. Over the next 10 years, the level of conventional production is expected to fall from its current levels, and it will ultimately wind up being dwarfed by the production from the oil sands. The quality of the production from the oil sands will be reliant on a number of factors. One factor is the technology of production. Different technologies produce different products, which is important to consider when looking at the refining market. Some operations may be able to tailor their output to the

---

specifications of refineries, but this is an often expensive process. Such processes will also be reliant upon operation in the traditional fashion. But if some inputs (e.g. natural gas) become too expensive for the process, then this will limit the ability to tailor production economically.

Figure 5 Canadian Bitumen Production

Source: EIA.

Figure 5 Canadian Bitumen Production\textsuperscript{17}

\textsuperscript{17}www.eia.doe.gov/emeu/cabs/canada.html, April 10, 2005.
Figure 6 Western Canadian Oil Production by Source

Figure 7 Western Canadian Oil Production by Commodity

---

Of the production in Western Canada, the growth is expected to be split between bitumen and synthetic oil blends. As stated earlier, conventional production (all grades) is expected to decline. The greatest parity of production between the two is expected to be around the 2005 production year. Greater increases in oil sands production are anticipated further out as more large scale projects come on line. The difference in quality of output has a number of implications for refiners. Most refiners are specialized to specific blends of crude. They can use other blends for their processes, but it reduces efficiency. So the type of product which is sold to refineries has important implications for the products, and may reflect the need for modifications by refiners.

**Local refineries and upgraders**

Upgrading is the process of converting bitumen from a hydrogen deficient, sulphur, nitrogen, oxygen, and heavy metal rich fluid to an upgrade or synthetic crude oil. The two primary methods of upgrading are coking and hydro-conversion. These methods employ different strategies towards upgrading. Coking reduces the level of carbon in the bitumen to produce upgrades, while hydro-conversion adds hydrogen. Hydro-conversion produces more barrels of upgraded product than at the start of the process, while coking generally leads around a 15% reduction in the volume from the start of the process.

Upgraders exist both as standalone units, as well as components of integrated operations. Standalone units are often able to process both raw bitumen and conventional heavy oil. The integrated units are generally bitumen specific, and are usually located in close proximity to their source of material (e.g. Suncor). The expected gap between bitumen production and upgrading capacity is 485,000 barrels a day for 2005. This
number may shrink by 2010, but is expected to remain above 400,000 barrels a day. A differential such as this implies the need for either more upgrading capacity in province, or export facilities designed for raw bitumen combined with increased refinery capacity designed to accommodate the source material.

The goal of the upgrading process is that refineries should then be able to process the former bitumen more easily. The upgrading process also aids in transportation, as upgrading produces much more pipeline-friendly products than the initial bitumen. Alberta does possess refining capacity, but it is insufficient to accommodate the current levels of production, let alone increased levels. Different refineries have different base oils, and different production slates, often varying with company planning. Many of the refineries in the province are located outside of Edmonton, which is a pipeline hub.

The United States

Global oil demand is still climbing. It was expected to be just below 80 million barrels a day in 2002, and it is over that number now. The greatest areas of demand growth are in rapidly expanding economies such as China and India. The level of demand from these regions is now one of the major factors affecting the price of oil. China is the most acute case of growing demand, as their economy is fuelled more by industrial factors than nations like India. The overall demand growth in these regions is an important consideration when looking at the future supply and demand situation. The North American market, while still growing, is not growing at anywhere near the pace of

---

the developing economies. The interaction between these two demand spheres may spark intense competition for available resources if little new production is brought on line globally. This would make the supply scenario less clear as to which producing regions would be supplying which major demand centers to a degree. This situation could benefit Canadian oil sands operators in prompting American refiners to modify their ideal inputs for Canadian bitumen and synthetic blends due to the ease of supply situations. Alternatively, the growing Asian markets may prove an excellent area for exports in the future.

As mentioned above, most demand projections predict a continued increase in the level of consumption in the US in the future. However, many of the estimates made for these numbers likely do not reflect the current market situation for crude oil based on price. Many of the forecasting models were basing their demand trends of a range of crude oil prices between US$24 and US$35 through 2025.21 While the current price levels may not be maintained, the current market status predictions made with lower price expectations may not reasonably be considered accurate.

Within the US market, there is differing demand by region. The densely populated East Coast (PADD I) has the highest level of petroleum use in the US. But the Gulf Coast (PADD III) is far and away the most intensive area in terms of fuel use per capita. This is most likely a consequence of the Gulf Coast’s early status as a major oil and gas producing region. The easy access to resources led to a fuel intensive culture developing in the region. This region is still the largest refining center in the US, and as such, is an important consideration in any discussion of oil and gas policy.

---

22 www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Dem_image_Consumption.htm#Click%20on%20regional%20area%20to%20see%20detail, April 11, 2005.
The level of US imports is another important consideration when examining US refinery demand. This is because the location of imports will have bearing on the type of crude oil which is being brought into the country. Over time, there are fluctuations in the levels of export to the US by different countries. As of 2003, Canada is the largest exporter of crude oil to the US, followed by Saudi Arabia, Mexico, and Venezuela. The situation in 1997 was different, with Venezuela being the largest exporter, followed by Canada, Saudi Arabia, and Mexico. The fluctuations in the level of imports reflect a variety of factors. In some cases (Venezuela) a significant factor has been the political stability of the government and the oil industry. Such events obviously influence prices,

---

as well as confidence in supply sources. This may tempt companies reliant on oil imports to look at different sources.

Canada represents the nation who has increased exports to the US the most over the 1997-2003 period. Exports increased by over 500 thousand barrels a day. Saudi Arabia was second over this period with an increase of over 350 thousand barrels a day. Mexican exports suffered a slight decrease in 2000, but rebounded to finish 2003 roughly 250 thousand barrels a day over 1997 levels. Venezuela is the only nation to post a continuous decrease in exports to the US over this period, sliding by around 400 thousand barrels a day. The gross level of US imports over this period increased by over 20%. This reflects both increasing demand, as well as declining domestic production.

<table>
<thead>
<tr>
<th>Venezuela’s Share of U.S. Gross Petroleum Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
</tr>
<tr>
<td>bbl/d</td>
</tr>
<tr>
<td>Venezuela</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>Mexico</td>
</tr>
<tr>
<td>Saudi Arabia</td>
</tr>
</tbody>
</table>

* million barrels per day including crude oil and petroleum products
Source: EIA

Figure 10 Gross US Oil Imports

Canada represents the nation who has increased exports to the US the most over the 1997-2003 period. Exports increased by over 500 thousand barrels a day. Saudi Arabia was second over this period with an increase of over 350 thousand barrels a day. Mexican exports suffered a slight decrease in 2000, but rebounded to finish 2003 roughly 250 thousand barrels a day over 1997 levels. Venezuela is the only nation to post a continuous decrease in exports to the US over this period, sliding by around 400 thousand barrels a day. The gross level of US imports over this period increased by over 20%. This reflects both increasing demand, as well as declining domestic production.

---

**US PADDs**

In the United States, there are five PADDs. The PADD abbreviation is short for Petroleum Allocation for Defence District. These districts were initially drawn up to delineate oil distribution during World War II.

---

![PADDs Diagram](Image)

**Figure 11 PADDs**

Canadian oil flows in part to almost every PADD in the US. The exception is PADD III (Gulf Coast), who have, in the past, produced the majority of their own oil, and currently import the remainder of the stocks they utilize from other nations. The Gulf Coast PADD is also a major center for the US refining industry. This PADD currently has a low percentage of operations which could process Canadian heavy oil to its maximum potential.

---

Currently, 45% of Canadian oil exports flow to the mid-West, PADD II. The majority of these exports flow through pipelines to Chicago, and are re-routed from there to later destinations. There is some level of export to PADDs IV and V, but this is not at the same level as the PADD II exports. There are currently no exports to the refining centers in PADD III, which would be a significant market to enter for Canadian exports, due to the overall intensity of activity in the region. There are also no exports to PADD I at the moment, as it is supplied mostly through links to PADD III.

The most likely areas for market expansion in the US by Canadian oil sands output are in the areas where there is already some degree of interaction. The most likely scenarios would see increased imports to PADDs II, IV, and V, while PADDs I and III would still obtain the majority of their oil from other sources.

---

Figure 12 Canadian Crude Disposition (2002)²⁸

Figure 12 also shows a number of the major import routes in the US for other foreign crude sources. The major import zones show a variety of factors. They show both the areas which are significant crude oil importers, but these also coincide with some of the major refining centers in the country as well.

Base oils, sources, and refineries

The US is still the world leader in refining capacity, with an estimated 16 million barrels a day of refining capacity. PADD III refineries dominate the localities in which refineries are located. This area concentration also corresponds to the scale of crude oil

---

imports which occur in each region. Crude oil imports for PADD III are in excess of 5 million barrels a day of crude oil.

For refineries, it is important to note the type of base stock which they utilize in their processes. There is a marked difference in the range of products which can be produced from a light sweet crude oil, and a heavy sour oil. The light crudes are able to be better processed to produce a range of higher value products. Heavier oils produce less of these high value products, and often have a significant portion of heavy residuum which is less useful, and must be sold at a discount relative to lighter crude stocks.\textsuperscript{31} Impurities such as heavy metals (which occur quite frequently in Canadian bitumen) also affect the suitability of base oils for different purposes.

\textsuperscript{31} \url{www.eia.doc.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Refining_text.htm#Crude%20Oil%20Quality}, April 11, 2005.
These kinds of considerations are a significant component of what Canadian producers need to be cognizant of when formulating their strategies and marketing in relation to the US refining market. If they fail to do this, they may misjudge the requirements of demand in these areas, and the consequences of such misjudgements could be very serious for a company’s goals and objectives.

---

Figure 14 US Refining Capacity by PADD

Thus, for Canadian exporters, knowledge of the current market conditions is extremely important. In line with this idea is the knowledge of what the refiners in the areas of expansion have traditionally used as their base oils. Canada’s traditional areas of export have a greater capacity for heavy oil than those markets they seek to expand into. The expansion markets have a small amount of heavy oil capacity (likely configured towards Venezuelan crudes) and a larger proportion of medium sour grade capability. The core regions do have capacity dedicated to synthetic blends, while there is virtually none of this in the extended market area. The expansion opportunities in PADDs I and IV are limited. The combined total refining capacity is around a third less than the

---

PADD V capacity on its own. PADD V is the lowest volume refiner of the three larger refining regions. PADD II has roughly 400 thousand barrels a day of capacity over that of PADD V, while PADD III has more than double the amount of any other PADD, with roughly 7.7 million barrels a day of refining capacity. This means that PADD III is the home of roughly half of the current refining capacity in the US.

![Refinery Crude Demand 2003](image)

**Figure 16 Refinery Demand by Market** (see Fig. 13)\(^{34}\)

**Potential switchover costs**

There are a variety of factors which will influence any decisions to move towards greater reliance upon the products of the Canadian oil sands in the US refining industry. As has been mentioned in other sections, the base oil has significant implications for the production of a refinery. There are also factors not associated with the inputs of refineries which are likely to have significant impact in the short term.

While switchover is more likely among current markets for Canadian exports, a breakthrough into PADD III would be a significant step for Canadian oil sands producers. To this end, there are a number of potential strategies that companies could employ to try to make their product more appealing to the US Gulf Coast market (USGC). One of the strategies is to create a blend which mimics the current inputs of refineries in this region. There is also the issue of ease of transportation for the product. Much of the heavy, sour capacity in the USGC refinery region is dedicated to Venezuelan and Mexican crudes which is transported via tanker ships. Venezuela has the largest conventional reserves (78 billion barrels) in the Western Hemisphere, and the export numbers in Figure 18 do no account for petroleum exports which are refined in the Caribbean, and then taken to the US. Some portions of the Saudi Arabian imports are also heavier blends of crude. But Saudi Arabia produces a variety of different grades of crude from its fields, so supplies a number of different base oils to refiners.

---

Given the relationship between Venezuela, Mexico, and the US in refining terms, it may be difficult to easily penetrate the heavy sour market which would be more in line with oil sands production. A more likely alternative is to mix synthetic crude production with Athabasca bitumen to in a 60-40 ratio to produce a medium sour blend. This would give the oil sands produces access to the next largest portion of the USGC refining industry that they could reasonably expect to compete in. The light crude segment is slightly larger than the medium sour, but there is no reasonable expectation of being able to produce a light crude from the oil sands.

Figure 18 An Acceptable Mix?  

Figure 19 Venezuelan oil production and exports to the US

---


38
Another point which must be highlighted is the current broad trend in the US refining industry as regards the physical plants themselves. There has been a consistent trend towards more complex, larger capacity refineries over the past 55 years. Newer refineries come online with greater capacity, and a greater array of outputs based on inputs than have previously been available. But the overall number of refineries is declining. Most of the refineries which close are those older installations with lower capacity and a simpler product slate. These closures are not unreasonable due to the current range of products which are desired from refining, and the closures are justifiable from an efficiency of production point of view. The danger in the increasing reliance on larger refineries in decreasing numbers is the risk of supply disruption in the event of unscheduled downtime for these operations. An example of this was seen in the recent fire and damage at BP’s refinery outside of Houston. This 450,000 barrel a day refinery is responsible for 3% of US refining. In the wake of the accident, gasoline prices spiked due to supply fears since the accident meant that there would be a lower gasoline supply in the market.\(^{39}\)

Answers in how to deal with this trend are difficult, and it is not an issue which is broadly acknowledged in many circles.

\(^{38}\) [www.eia.doe.gov/emeu/cabs/venez.html](http://www.eia.doe.gov/emeu/cabs/venez.html), April 14, 2005.

There are other issues associated with the refining industry in the US which must be considered as well. Two issues which I will highlight are jointly part of the overall third component.

The first significant component to recognize is the cost associated with switching base inputs. To achieve the best results, a refinery should be tailored to a specific signature of crude oil. If an existing unit is to move to a new base, extensive modifications must be made in order to achieve the maximum efficiency level which is possible.

The second component to consider is the current clean air legislation. In 1990, and amendment to the Clean Air Act was amended to attempt to decrease emissions on a national level. There are obviously a number of different foci for this legislation. The refining industry is affected in two ways. There are direct emissions from there plants which must be addressed. And then there is a significant portion of the legislation which

---

deals with emissions from automobiles. These considerations take a number of forms. There are attempts to increase the fuel efficiency of vehicles, in order to decrease emissions through that route. But there are also new regulations in place regarding the quality of fuel, as this is another significant factor in emissions. These combined issues mean that there will be many refiners who find it necessary to modify their plants in order to be compliant with these new regulations.

The Clean Air Act and the base fuel switchover are both significant cost considerations. Each set of modifications on its own would likely run into the tens, if not hundreds of millions of dollars. Combined, these expenses may be more than many refiners would be able to bear for reasonable results. Some may be able to afford both, but the question of their company strategy will also come into play. If they do not wish to switch base oils as they feel they have a reliable supply of another kind, then it would not be to their advantage. Refineries that may be wish to switch base oils may not be able to, or at least not at the same time. They may be able to afford the separate procedures at different times. Given the two modifications, it is likely that those which pertained to the Clean Air Act would be given priority due to potential penalties for non-compliance. This situation is likely currently complicating many decisions regarding future input base for refiners. Once these considerations are dealt with, I would expect greater emphasis to be place upon the base oil situation by companies.

---

Transportation

Since the late 1990’s, pipeline capacity out of Western Canada has increased by 550,000 barrels a day. But still greater capacity is needed with continued expansion of the oil sands. CAPP has estimated that there must be at least a 600,000 barrel per day increase in capacity within the next decade.\(^{42}\)

Figure 21 Existing Major Pipeline Capacity\(^{43}\)

There are a number of routes which have been proposed which would lead to increased pipeline capacity from Western Canada to the US. The two major proposals identified in a paper for CAPP were a western line, to take production from Hardisty to the Californian market, and a new line to Chicago with a potential reversal of an existing line which would take production on to Cushing, Oklahoma.\(^{44}\) Another option which was highlighted was a potential line to Prince Rupert, from which production could be transported by tanker to other destinations. This option will be discussed in greater detail.

in the section on other alternatives (for Canadian producers). The current situation would favour development of the Prince Rupert line. However this judgment is predicated upon the American refiners not adding more capacity for heavy oil. If US refiners did follow such a route, and introduced more dedicated heavy oil capacity that would change the economic situation for determination of optimal pipeline expansion routes.

| EXPECTED WESTERN CANADIAN CRUDE AVERAGE NETBACKS (US Dollars per Barrel) |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|
|                             | 2006        | 2007        | 2008        | 2009        | 2010        |
| Chicago w/Cushing Connection| 18.40       | 18.02       | 17.82       | 17.76       | 17.03       |
| BC West Coast Pipeline      | 18.93       | 18.79       | 18.50       | 18.44       | 17.65       |
| California Pipeline         | 18.76       | 18.51       | 18.29       | 18.32       | 17.54       |

**Figure 22 Expected Netbacks of Pipeline Alternatives**

**Figure 23 Estimated Costs of Pipeline Options**

Other alternatives

Alternative markets for Canadian exports

One of the three major potential pipeline expansion projects would be to build a line to Prince Rupert, British Colombia. Such a pipeline would allow for greater exports to the Pacific Rim, which contains a number of fast growing economies (e.g. China) and is one of the leading areas of demand growth in the world. In fact, the demand increase in China is one of the major factors influencing the current price of crude oil.\(^{47}\) And China is interested in obtaining resources from a variety of different sources. The Chinese demand is expected to continue increasing to roughly 7.2 million barrels a day. This is following its recent spike in demand to fuel both its industries, and its new consumer markets.\(^{48}\)

![Figure 24 Trend of Chinese Oil Demand](http://news.bbc.co.uk/2/hi/business/4191683.stm), March 9, 2005.


An export pipeline to the West Coast would benefit heavy producers’ more than synthetic light producers. Pipelines in this direction would serve either the California market, or export facilities targeting to Asian markets. At the current time, it is estimated that there is approximately 100,000 barrels a day demand for the products of the oil sands in the North Asian market. At the same juncture, there is estimated to be a market of at least 300,000 barrels a day demand in the Californian market which could be accessed if a pipeline where built to the West Coast (Prince Rupert).

But there is significant potential for future demand increase in the Asian market, and a number of factors could combine to highlight the attractiveness of Canadian oil sands exports to the region. The majority of US refineries are configured for oils which produce an array of products, ranging from the light, through the heavy components. Canadian synthetic blends have little in the way of these light and heavy components, and are strongly weighted in the middle of the production slate. This petrochemical signature is more commonly associated with the refineries and base oils of Asian refineries. These refineries are generally of a simpler set up than current US operations. But this match

---

between the output of oil sands operators, and the refineries in Asia could prove to be an interesting dynamic in the future.

**Alternative sources for American imports**

There are a variety of oil producing regions around the world which could feasibly supply US demand in the future. Many of these nations already supply the US to some degree. Among the other areas of supply are the Middle East, which still boasts the largest conventional crude oil inventories in the world, Venezuela, with its large deposits of heavy oil, and Africa, principally Nigeria. There are pros and cons associated with each of these areas as a potential source. In each case, the crude blends marketed by these areas has a more complete hydrocarbon complement than is offered by Canadian producers (although not much more complete in the case of Venezuela). This point is important to the refiners from the production view and the slate of products that they can produce from these imports. One of the major advantages of the Canadian production is the security and stability of supply. Canada is a stable, democratic nation, with a free market economy. This is an appealing combination compared to the instability in areas like the Middle East and Nigeria. Venezuela has also had a number of differences with the US during the Chavez presidency, although that has not yet had significant impact on the physical flow of oil from Venezuela to the US. So the security of supply could be a major argument in favour of some American refiners moving to Canadian oil sands production as a base supply. The market access in these regions could also be a significant factor. Canada and the US share a contiguous border, and already have significant infrastructure in place between the two nations for the exchange of oil and natural gas. The US is the nearest major market to Canada, and Canada offers a reliable
supply to the US with a level of confidence in the reserves figures and estimates. Other producing areas are located at further distances from the US, near to other major markets and developing markets. The Middle East supplies output to the US, Europe, and Asian markets. With demand increasing in Asia and Europe, it is possible that the production from this region may move more towards these markets than to the US due to relative ease of transport, combined with economic factors. African supply may increasingly come to supply Europe, although this is a more arguable point due to the similar transportation issues facing both European and American markets depending on the producing region within Africa. There is also the possibility that production from Nigeria and Venezuela could move south towards the expanding Brazilian economy. If demand climbs there, it could prove to be a major market. This scenario would likely take some time to fully express itself, and the current supply situation is likely to be maintained for the near future.
So the current supply situation for the US is likely to be relatively stable for the near future. The longer term prospects seem to indicate that there may be a number of potential shifts in the supply chain. The timing of such shifts, as perceived by different players in the industry may well be what drives a change in refineries base oils forward.

\[54\text{ www.eia.doe.gov/emeu/security/oilflow2.gif, April 13, 2005.}\]
Conclusions

The potential for significant impacts on the American refining industry from the continued growth of production from the Alberta oil sands can be seen from the situations described throughout the paper. The Alberta reserves in the oil sands offer a stable, long term supply of bitumen and bitumen derivatives which can be utilized by the US refining industry. The US refining industry, which is the world’s largest, is currently facing a number of different challenges. Some of these challenges relate to the sources of their oil supply, and strategic decisions they must make about those situations. Other decisions relate to the status of legislation regarding the operations and products of their business. There are also a number of regional differences within the industry, with significant variability in capacity and style of production depending on the PADD of the operation.

There are also separate alternatives available to both American refiners and Canadian producers. American refiners can continue to rely on imports from other areas of the globe, due to potential benefits relating to the slate of products which can be produced from different crudes. Canadian producers have the option of potentially exploring new markets for their production, such as Asia. There is currently a great deal of interest in nations such as China in securing supplies for their energy and industrial future. There are a variety of options which both Canada and the US could proceed in these matters.

But the nearness of the American market and the reliability of the Canadian supply will likely be major factors in the determining the shape of events to come. The demand for oil and petroleum products is still increasing globally, and there will be many developments which affect those markets in the future.
References

http://news.bbc.co.uk/2/hi/business/4191683.stm
http://news.bbc.co.uk/1/hi/world/americas/4377519.stm
http://pubs.usgs.gov/fs/fs70-03/fs070-93.html
www.capp.ca/default.asp?V_DOC_ID=675
www.capp.ca/default.asp?V_DOC_ID=688
www.capp.ca/raw.asp?x=1&dt=NTV&e=PDF&dn=62752
www.capp.ca/raw.asp?x=1&dt=PDF&dn=83040
www.eia.doe.gov/emeu/cabs/canada.html
www.eia.doe.gov/emeu/cabs/venez.html
www.eia.doe.gov/emeu/security/oilflow2.gif
www.eia.doe.gov/oiaf/aeo/forecast.html
www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Dem_image_Consumption.htm#Click%20on%20regional%20area%20to%20see%20detail
www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/paddmap.htm
www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Refining_text.htm#Crude%20Oil%20Quality
www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Refining_text.htm#U.S.%20Refining%20Capacity
www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Trade_image_usregl_imp.htm
www.emis.platts.com/thezone/guides/platts/oil/glossary.html