



THE SCHOOL OF PUBLIC POLICY

MASTER OF PUBLIC POLICY CAPSTONE PROJECT

REFINE WHERE YOU MINE:

Is government involvement in domestic bitumen processing necessary for Alberta?

Submitted by:

Naomi Christensen

Approved by Supervisor:

Dr. Michal Moore, Approved August 14, 2014

Submitted in fulfillment of the requirements of PPOL 623 and completion of the requirements for the Master of Public Policy degree



THE SCHOOL OF PUBLIC POLICY

Acknowledgements

Many thanks to Dr. Michal Moore for his guidance on this project.

Additional thanks to Dr. Ted Morton for insights into the government of Alberta's BRIK program.

TABLE OF CONTENTS

I.	Introduction.....	1
	(i) Definitions.....	2
	(ii) History.....	5
	(iii) Context.....	9
II.	Literature Review.....	15
III.	Methodology.....	24
IV.	Findings.....	25
	(i) Reasons for increasing the amount of bitumen upgraded within Alberta.....	26
	(ii) Examination of arguments for increasing bitumen processing within Alberta.....	31
	(iii) Reasons against increasing the amount of bitumen upgraded within Alberta.....	36
V.	Case Studies.....	44
	(i) North West Upgrader.....	44
	(ii) Voyageur Upgrader.....	47
	(iii) Kitimat Clean Bitumen Refinery.....	50
	(iv) Partial Upgrading Technology.....	55
VI.	Public Opinion.....	59
VII.	Policy.....	63
	(i) Current Government of Alberta Policy re: Upgrading.....	63
	(ii) Implications of current Government of Alberta Policy.....	65
VIII.	Conclusion.....	65
IX.	Recommendations.....	66



Capstone Executive Summary

The province of Alberta, home of the Canadian oil sands, contains the third largest known oil reserves on the globe. Extraction of bitumen from the oil sands is a key reason for the growth of Alberta's economy. A major public debate within the province is whether Albertans can realize even greater value from this resource by increasing the amount of bitumen processed in the province via upgrading and refining.

This report investigates the major arguments in the debate over whether or not more domestic bitumen processing would benefit the province, with the goal of determining whether or not the government should be involved. It finds the arguments in favour of increasing the amount of local upgrading are based largely in philosophical arguments that jobs and government revenue will increase, without offering a proven economic basis to back the argument. Arguments cautioning against investments into increasing local upgrading and refining capacity point to the current and future market and economic conditions that are causing great uncertainty about the ability to gain a return on this type of investment.

A thorough examination of stakeholder positions, industry actions, and case studies of bitumen upgrading and refining projects in Alberta and British Columbia suggests there is no apparent reason increasing bitumen processing within provincial borders will make Albertans better off. In addition, current government of Alberta policy on this file is spending government revenue and placing taxpayers at further financial risk. Based on my analysis, this report offers alternative policy options for the provincial government around bitumen processing in Alberta.

I. Introduction

This report examines the upgrading and refining capacity of bitumen in the province of Alberta. Its purpose is to provide clear picture of the current economic and political factors affecting the bitumen processing sector in Alberta in order to determine what role – if any – the provincial government should have on this file moving forward.

The many opportunities and challenges facing Alberta's energy sector often leads to spirited public policy debates over the appropriate course of action to maximize the benefits that flow to the province from (primarily) the oil and gas sector. One topic receiving considerable attention over the last decade is whether or not to upgrade and refine more oil sands bitumen closer to the source. The central questions in this debate are whether Albertans are losing benefits in the form of value added jobs and government revenue by transporting bitumen out of the province to be refined into finished products and what, if any, action the provincial government should take to address the upgrading and refining capacity of bitumen within provincial borders.

This report focuses solely on the processing of one specific hydrocarbon product extracted in Alberta – oil sands bitumen. It deals only with upgrading and refining as it relates to bitumen, and will not delve into the topic of conventional oil refining. I begin by defining key terms the reader must use to follow the current policy debate. This is followed by a brief history of the processing of oil sands bitumen within the province. As neither private industry nor government can (or should) make decisions in a vacuum, a broader context of the current Canadian, North American and global circumstances of heavy oil processing is surveyed. In the literature review, the major reports released on this topic over the last few years are

summarised. The body of the report looks at the two main positions of the current debate; the side advocating for government action to ensure an increasing amount of bitumen is upgraded and/or refined inside Alberta, and the economic factors that deter investment into increasing upgrading and refining capacity at this time.

This report examines the current and projected economic conditions facing the downstream oil sector since the 2008 global economic downturn, the investments planned by industry to expand upgrading capacity in Alberta prior to the recession, and the reasons why the majority of those planned investments have been stalled or cancelled. It outlines the arguments that are mainly political rather than economic in nature, most commonly made by those pushing for additional bitumen upgrading within the province. I also outline and evaluate the Alberta government's current policy and action on this issue. Specific projects, such as the North West Upgrader in Alberta and Kitimat Clean refinery on the coast of British Columbia are included as illustrations although public details on both are relatively slim. Several policy recommendations for the Government of Alberta form the report's conclusion.

(i) Definitions

Bitumen

Oil sands bitumen is an extra heavy crude oil with a high viscosity that is “generally of lower value than the light sweet varieties [of crude] that have historically dominated Canadian production.”¹ Due to its thickness, it is difficult to transport in its natural form – in fact at room temperature, bitumen is a solid.² After extraction, bitumen must either be upgraded or diluted

¹ Conference Board of Canada, *Canada's Petroleum Refining Sector: An Important Contributor Facing Global Challenges*, (Ottawa: Conference Board of Canada, 2011), p. 2.

² IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 2.

to make it transportable, and then undergo “significant processing” to be converted into higher value-added products.³

Upgrading

Upgrading is defined as “any fractionation or chemical treatment of bitumen or heavy oil to increase its value.”⁴ Bitumen upgraders are facilities built to process raw bitumen as a feedstock and produce lighter crude that is then used as a sub-feedstock in oil refineries.⁵ At a minimum, upgrading can be used to reduce the viscosity of bitumen which facilitates its transportation via pipeline without a solvent.⁶ At a maximum, upgrading can be used to turn bitumen into synthetic crude oil (SCO).⁷ SCO “resembles light, sweet crude oil”⁸ and is therefore easier to transport than raw bitumen. However, upgrading bitumen is not the only option available to oil sands producers to make their product transportable. Bitumen can also be blended with a condensate, making it viscous enough to be shipped through a pipeline.⁹ “The most common bitumen blend involves diluting bitumen with a natural gas condensate to make a substance called dilbit” but can also be diluted using other light hydrocarbons.¹⁰

³ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 1.

⁴ Murray R. Gray, “Tutorial on Upgrading of Oil Sands Bitumen,” University of Alberta, Department of Chemical and Materials Engineering, <http://www.ualberta.ca/~gray/Links%20&%20Docs/Web%20Upgrading%20Tutorial.pdf>, p. 4.

⁵ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 8.

⁶ Gray, “Tutorial on Upgrading of Oil Sands Bitumen,” p. 4.

⁷ Gray, “Tutorial on Upgrading of Oil Sands Bitumen,” p. 4.

⁸ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 2.

⁹ *Ibid.*, p. 1.

¹⁰ *Ibid.*, p. 2.

Refining

Refining is “the manufacturing stage of petroleum production.”¹¹ The refining process takes crude oil products such as bitumen that has been upgraded into SCO or blended into diluted bitumen (dilbit) and turns it into useable petroleum products. Oil refineries produce a large range of finished petroleum products, and “are not the same as bitumen upgraders. Refineries are more complex facilities, built and configured to process crude oil – ‘from heavy to light, from sour to sweet and now synthetic, into products such as gasoline, diesel, aviation fuel and home heating oil.’”¹² Bitumen that is upgraded into SCO is shipped to refineries that are configured to process light crude oil. Blended bitumen and dilbit are transported to refineries that are configured to process heavy crude oil.¹³

Value Added

Value added is an economic term defined by the Oxford Dictionary as “[t]he amount by which the value of an article is increased at each stage of its production, exclusive of initial costs.”¹⁴ Upgrading bitumen is often referred to as adding value to the raw resource, as it alters the heavy bitumen into a lighter, and more valuable, petroleum product. The next step in the downstream process, refining the upgraded (or diluted) bitumen, again adds value by transforming it into finished products ready for final sale. IHS CERA refines this by suggesting that “[u]pgraders improve the quality of oil sands crude oil, but they do not add production.”¹⁵

¹¹ Conference Board of Canada, *Canada’s Petroleum Refining Sector*, (Ottawa: Conference Board of Canada, 2011), p. 10.

¹² House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 8.

¹³ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 1.

¹⁴ Oxford English Dictionary, “value added,” accessed June 9, 2014, <http://www.oxforddictionaries.com/definition/english/value-added>.

¹⁵ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 16.

Therefore while upgrading is often referred to as a value adding activity, it may not actually be a correct description.

(ii) History

In 1967, Great Canadian Oil Sands (today part of Suncor Energy) initiated the first large-scale operation in the Athabasca oil sands near Fort McMurray, Alberta.¹⁶ In the first wave of oil sands development that followed, extraction occurred through surface mining. Only twenty per cent of oil sands reserves are located close enough to the surface of the land to be recoverable with this method; the other eighty per cent became recoverable only more recently as technological developments made new extraction processes feasible. The first commercial in-situ drilling project was not launched until 2001.¹⁷ In January 2014, out of over 100 oil sands projects in Alberta, only four involve surface mining (with a fifth under construction.)¹⁸ This shift in the way bitumen is extracted led to a change in the way bitumen is converted into a transportable product. IHS CERA notes that

“[i]n the early years of oil sands development (when commercial production was limited to surface mining operations), extraction methods required bitumen to be upgraded. However, today, new mining extraction techniques have been developed that enable producers to transport blended bitumen, without upgrading. Production by in-situ extraction, a growing source of oil sands supply, also does not require upgrading prior to shipment to market.”¹⁹

Since the early 2000s, an increasing use of in-situ mining is being used to extract the eighty per cent of bitumen not recoverable through surface mining. Consequently it is less

¹⁶ Alberta Energy, “Energy’s History in Alberta,” accessed May 1, 2014, http://www.energy.alberta.ca/About_Us/1133.asp.

¹⁷ Canadian Association of Petroleum Producers, “Oil Sands Today – History,” accessed May 2, 2014, <http://www.oilsandstoday.ca/whatare oilsands/Pages/History.aspx>.

¹⁸ Canadian Association of Petroleum Producers, “Oil Sands Today – Recovering the oil,” accessed May 2, 2014, <http://www.oilsandstoday.ca/whatare oilsands/Pages/RecoveringtheOil.aspx>.

¹⁹ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 3.

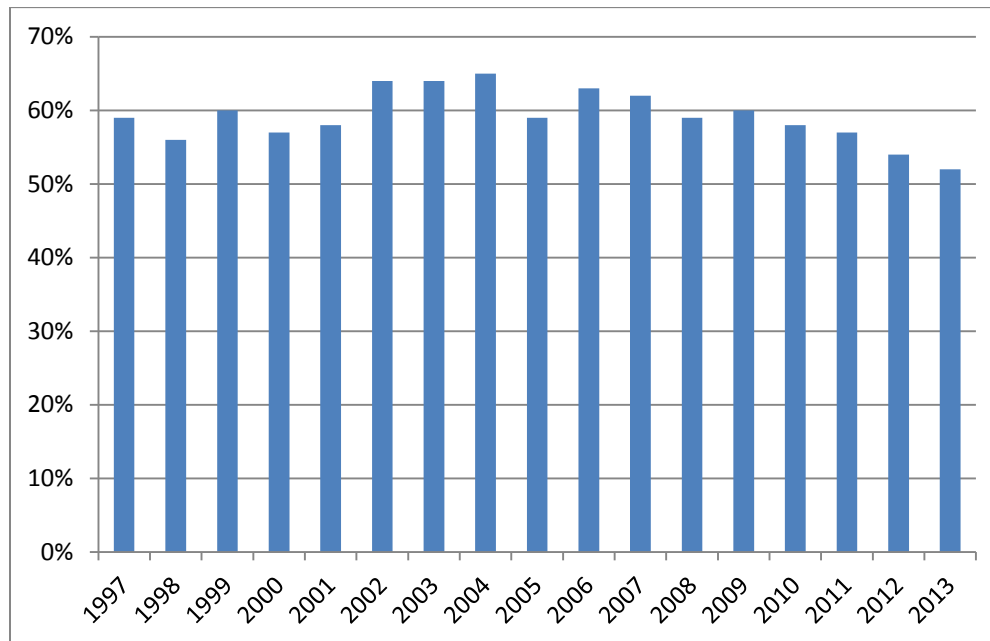
necessary for companies involved in oil sands production to be vertically integrated; in other words to have an upgrader located at their operation sites to convert bitumen into a transportable product. This partly explains why despite the growth in oil sands production, a parallel growth in upgrading facilities and capacity is not occurring. This has sparked some concern and ignited a debate over what this means for the province and what the appropriate amount of local upgrading should be.

Despite the changing nature of oil sands extraction and the resulting changes in how industry chooses to convert bitumen into transportable products, since 1997 the *percentage* of bitumen upgraded in the province has not decreased as dramatically as one might assume. As shown in Figure 1; between 1997 and 2013 the percentage of bitumen upgraded in the province has fluctuated between fifty-two and sixty-five per cent. 2004 saw the largest amount of in-province bitumen upgrading at sixty-five per cent, while most recently in 2013 the least amount of upgrading occurred with fifty-two per cent processed within Alberta. The Alberta Energy Regulator projects the percentage of bitumen upgraded inside the province to continue to decline, dropping to thirty-six per cent in 2023.²⁰ Bitumen that is not upgraded, refined and consumed within Canada – roughly half the amount extracted from the Alberta oil sands - is exported to the United States as either dilbit or SCO to undergo refining.²¹

²⁰ Alberta Energy Regulator, *ST98-2014: Alberta's Energy Reserves 2013 and Supply/Demand Outlook 2014–2023*, (Calgary: Alberta Energy Regulator, 2014), pp. 3-23.

²¹ Nicolas Choquette-Levy, Heather L. MacLean, and Joule A. Bergerson, "Should Alberta upgrade oil sands bitumen? An integrated life cycle framework to evaluate energy systems investment tradeoffs," *Energy Policy* 61 (2013), p. 79.

Figure 1: Yearly Percentage of Bitumen Upgraded in Alberta



Source: data from Alberta Energy

As of July 2014, there are five upgraders currently operating in Alberta, with a combined capacity to handle around 1.3 million barrels per day (bpd) of bitumen.²² One facility, Canadian Natural Resource Ltd's Horizon Upgrader, is under a three phase construction plan to expand its upgrading capacity by a total of 135,000 bpd.²³ In 2012, the oil sands produced about 1.9 million bpd of bitumen and fifty-four per cent (1,004,000 bpd) of bitumen was upgraded in the province.²⁴ If the entire capacity of the five upgraders had been utilized in 2012, approximately sixty-eight per cent of bitumen extracted from the oil sands and could have been upgraded within Alberta.

Of the four oil refineries located in Alberta, two are configured to use oil sands feedstock and one uses conventional oil. Another, the Husky Asphalt Refinery located on the

²² Alberta Energy, "Upgrading and Refining," last modified February 10, 2014, <http://www.energy.alberta.ca/Oil/pdfs/FSRefiningUpgrading.pdf>.

²³ Ibid.

²⁴ Ibid.

Alberta side of the border city of Lloydminster, is integrated with Husky's upgrader on the Saskatchewan side of the city, which produces SCO from heavy oil extracted in both provinces.²⁵ The North West Upgrader, a fifth facility currently under construction in Alberta's industrial heartland north-east of Edmonton, will refine bitumen directly into finished petroleum products such as diesel, diluent, and naphtha rather than refining upgraded bitumen feedstock.

Unlike other provinces such as British Columbia and Quebec that have experienced refinery closures in recent years, "Alberta has expanded production, and thus its relative importance on the national stage"²⁶ (this includes refining of both light and heavy crudes). This expansion is a result of the increase in oil production in the province, which in turn has made Edmonton one of the major refining centers in Canada.²⁷ By 2009, production of refined products in Alberta was eighty per cent greater than twenty-five years ago; little of this growth occurred past 2000.²⁸ Oil refined in Alberta mainly supplies markets in the other western provinces, with very little (four per cent) being exported outside Canada.²⁹

²⁵ Ibid.

²⁶ Conference Board of Canada, *Canada's Petroleum Refining Sector*, (Ottawa: Conference Board of Canada, 2011), p. iii.

²⁷ Ibid., p. 16.

²⁸ Ibid.

²⁹ Ibid., p. 19.

Table 1: Current and Planned Heavy Oil Upgraders and Refineries in Alberta

Operating Upgraders			
Name	Date of Inception	Location	Capacity (bpd bitumen)
Suncor Base & Millenium	1967	Fort McMurray	440,000
Syncrude Mildred lake	1978	Fort McMurray	407,000
Shell Scotford	2003	Fort Saskatchewan	255,000
Nexen Long Lake	2008	Fort McMurray	72,000
CNRL Horizon	2009	Fort McMurray	141,000
			Total: 1,315,000
Operating Heavy Oil Refineries			
Name	Date of Inception	Location	Capacity (bpd)
Suncor		Edmonton	140,000
Husky Asphalt Refinery	1947	Lloydminster	28300
Shell Canada	1984	Scotford	100,000
			Total: 268,300
Proposed Projects			
Name	Target Completion	Location	Capacity (bpd) Products
CNRL Horizon Expansion	2014 (Phase 2A)	Fort McMurray	135,000
	TBD (Phase 2B & 3)		
North West Upgrader	2017 (Phase 1)	Sturgeon County	150,000

Source: Alberta Energy

(iii) Context

Canada is part of the North America economy; and economy influenced by the wider world economy. Decisions made outside Alberta influence demand for our raw resources, access to markets, and even the costs of constructing heavy oil upgrading and refining facilities. For these reasons, activity in other jurisdictions must be taken into account when making decisions about whether or not to upgrade bitumen and refine bitumen products inside Alberta. What follows is a brief overview of the current state of heavy oil processing in the Canadian, North American and global economies.

Canada

In addition to the five upgraders located in Alberta, there are eighteen oil refineries in operation across Canada. Only some are configured to process heavy crudes. Although the number of Canadian refineries has declined from a high of forty-four in 1960, the overall capacity of Canada's refining sector has increased.³⁰ This has been made possible by massive capital investments (\$40 billion since 1980) targeted at greater operational efficiency.³¹ However, in comparison to other countries, "Canadian refineries are small by international standards and don't enjoy the same economies of scale as established competitors in the US and emerging competitors in Asia."³²

Canada's refining sector is a net exporter, exporting about twenty per cent of refined petroleum products to the U.S.³³ Historically and to this day, refineries located in Western Canada tend to use domestic oil as a feedstock, whereas refineries in Central and especially Atlantic Canada use a majority of imported oil. Most Canadian refineries "lack the complexity required to refine heavy crudes and bitumen."³⁴ The Canadian Fuels Association explains that

"only about 60 percent of the crude processed by Canadian refineries is sourced from domestic production since refineries in Eastern Canada have only limited access to Western Canadian crude supplies. Proposed pipeline projects (Enbridge Line 9 reversal, TransCanada Energy East project) would enable greater access to Canadian crude for Eastern Canadian refineries. However, Eastern Canadian refineries are generally configured to process light crude oil."³⁵

³⁰ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 12.

³¹ Conference Board of Canada, *Canada's Petroleum Refining Sector*, (Conference Board of Canada, 2011), pp. 1, 24.

³² Canadian Fuels Association, *The Economics of Petroleum Refining: Understanding the business of processing crude into fuels and other value added products*, December 2013, p. 15.

³³ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 11.

³⁴ Canadian Fuels Association, *The Economics of Petroleum Refining*, December 2013, p. 15.

³⁵ *Ibid.*, p. 6.

In terms of optimizing profitability, refineries typically need to operate above a ninety per cent utilization rate.³⁶ Canadian refineries have been operating below this point since even before the 2008 recession.³⁷ Since 2008, utilization rates for refineries in Western Canada and Ontario have averaged eighty per cent, while refineries in Atlantic Canada and Quebec have achieved only a slightly better output with an average utilization rate of eighty-four per cent.³⁸ One of the reasons for this decline in utilization of refining capacity is the changing demand for refined petroleum products throughout North America where demand is flat to declining, primarily due to stagnation in demand for gasoline.³⁹

North America

North America has an integrated system of oil pipelines that transport crude feedstocks to oil refineries, and refined petroleum products to market. In the United States, the system supports 139 refineries,⁴⁰ organized into five geographical Petroleum Administration for Defense Districts (PADDs) to reflect the major refining regions.⁴¹ While Canada has limited capacity to process heavy oil, many refineries in the United States, especially those located in the Midwest (PADD II) and on the Gulf Coast (PADD III) are specifically configured to process heavy crude,⁴² and currently have excess capacity.

³⁶ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 12.

³⁷ Ibid.

³⁸ Ibid., p. 19.

³⁹ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 8.

⁴⁰ U.S Energy Information Administration, "Number and Capacity of Petroleum Refineries," accessed May 3, 2014, http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm.

⁴¹ M.C. Moore, S. Flaim, D. Hackett, S. Grissom, D. Crisan, and A. Honavar, "Catching the Brass Ring: Oil Market Diversification Potential for Canada," *University of Calgary, School of Public Policy* Vol. 4 Issue 16, December 2011, p. 12.

⁴² Ibid., pp. 8-9.

Increasing production in the oil sands is coinciding with a decrease in the availability of heavy oil supplied by Mexico and Venezuela to refineries on the U.S gulf coast. Mexico is now exporting heavy oil to refineries in India that are equipped to handle heavy crude, while production from its major offshore oil field (Cantarell) is declining.⁴³ The coincident increase in demand for Canadian heavy oil as a feedstock for gulf coast refineries⁴⁴ is one of the major economic arguments in favor of constructing the Keystone XL pipeline.⁴⁵ Due to the interconnectedness of the North American economy, companies operating in heavy oil production in Canada – many of which are international players - may find it more profitable to utilize available refining capacity in the U.S rather than invest in refining facilities closer to the point of extraction. For example, “[a]fter cancelling or delaying more than US\$100-billion of processing capacity at the onset of the financial crisis in 2008, energy players are counting on major pipelines to transport growing volumes of less processed diluted bitumen to refineries in the United States that are better equipped to handle the extra-thick crude.”⁴⁶ As shown in Table 2 below, in some instances companies involved in oil sands extraction in Alberta own and operate oil refineries in the United States. For companies like these, it likely does not make economic sense to build a processing facility at the point of extraction when they can utilize an existing facility in the U.S at no extra cost.

⁴³ Personal Communication with Montserrat Ramiro, Instituto Mexicano para la Competitividad A.C., June 2, 2014.

⁴⁴ Canadian Fuels Association, *The Economics of Petroleum Refining*, December 2013, p. 11.

⁴⁵ Brian Lee Crowley, “Markets hunger for Canadian bitumen, not refined oil,” *Globe & Mail*, October 3, 2013, <http://www.theglobeandmail.com/report-on-business/economy/economy-lab/markets-hunger-for-canadian-bitumen-not-refined-oil/article14688599/>.

⁴⁶ Jeff Lewis, “How upgrader plants are giving way to new oil sands technologies,” *Financial Post*, January 1, 2014, http://business.financialpost.com/2014/01/01/how-upgrader-plants-are-giving-way-to-new-oil-sands-technologies/?_lsa=8c45-8206.

Table 2: Number of U.S refineries owned by companies involved in oil sands extraction

	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	Total
British Petroleum	0	2	1	0	2	5
Chevron	1	0	1	1	3	6
ConocoPhillips	2	2	4	1	6	15
Exxon Mobil	0	1	4	1	1	7
Shell	0	0	2	0	2	4
Suncor	0	0	0	1	0	1

Source: Andrews et al footnote 47 below

Another more recent factor affecting the North American refining sector is the development of tight oil. Abundant reserves of tight oil – also called shale oil – exist in both Canada and the United States. Shale oil is a light crude and its growing volume, which provides North American refineries with a readily available light feedstock, is decreasing incentives to invest in converting facilities to be capable of processing heavy crudes like bitumen.⁴⁸

Global

In sharp contrast to North America, it is the world's developing countries, especially China, that are increasing their demand for refined petroleum products.⁴⁹ OPEC's 2013 World Oil Outlook anticipates that overall global refining capacity will increase between 2012 and 2035, and projects the majority of that increase – eighty per cent – to come from the emerging economies in the Asia-Pacific.⁵⁰ According to OPEC, there are over thirty planned refining projects in China, focusing on “efficient facilities with complex conversion capacity capable of processing heavy crudes.”⁵¹ The government of China “has an explicit policy preference for meeting domestic fuel demand with domestic refineries. Chinese refining capacity is expected

⁴⁷ Anthony Andrews, Robert Pirog, and Molly F. Sherlock, “The U.S Oil Refining Industry: Background in Changing Markets and Fuel Prices,” (Washington: U.S Congressional Research Service, 2010), pp. 5-11.

⁴⁸ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 20.

⁴⁹ *Ibid.*, p. 8.

⁵⁰ Canadian Fuels Association, *The Economics of Petroleum Refining*, December 2013, p. 8.

⁵¹ *Ibid.*

to grow by 3 million bpd by 2017 to meet forecast demand growth.”⁵² If Canada is able to gain market access to the growing Asian economies and these countries increase their own refining capacity, the demand from these markets is likely to be for crude feedstock rather than finished petroleum products. The Conference Board of Canada even forecasts that “modern super-refineries [...] being built in China, India, and other developing nations” will “provide a new competitive source of refined products – especially gasoline – for export to North American markets.”⁵³ The refining sector in China is virtually completely state-owned, while in India the number of privately owned refineries has been on the rise during the last decade.⁵⁴ “Private Indian refiners have increased domestic production sharply, since one of their objectives has been to supply products to other Asian markets.”⁵⁵

Canada is not the only country whose refining sector felt and impact from the 2008 economic recession; after 2008 the global refining utilization rate has been below ninety per cent utilization, “reflecting a surplus of refining capacity.”⁵⁶ At the same time, “global refining capacity has been shifting to emerging markets, especially Asia, where demand is growing the fastest.”⁵⁷

Alberta’s petroleum processing sector can only be fully understood in the context of its position in the North American and global economies. As I outline below in a review of the literature written on this topic over the past decade, many economic and policy factors

⁵² Ibid., p. 11.

⁵³ Conference Board, *Canada’s Petroleum Refining Sector*, (Ottawa: Conference Board of Canada, 2011), p. ii.

⁵⁴ Edward Osterwald, “Review of the Proposed Kitimat Refinery Project,” (Rancho Cordova, CA: Navigant Consulting Inc., March 2013), pp. 19-20.

⁵⁵ Ibid., p. 20.

⁵⁶ Canadian Fuels Association, *The Economics of Petroleum Refining*, December 2013, p. 12.

⁵⁷ Ibid.

occurring outside the province have and will continue to impact Alberta's bitumen processing sector.

II. Literature Review

Refining is described as an enterprise that is “low return, low growth, capital intensive, politically sensitive and environmentally uncertain.”⁵⁸ The same holds true for upgrading.

Economic analysis' on this topic has identified a myriad of intertwining factors that determine whether or not an oil processing facility will be profitable, and how profitable.

Those who are skeptical about making investments into increasing the upgrading and/or refining capacity of bitumen and heavy oil in Alberta – and Canada, for that matter – base this assumption on the current economic conditions making profitability from investments in these types of projects uncertain, and the many challenges faced by the downstream oil sector that compounds this uncertainty. In recent years, several major reports looking into the economics of upgrading and refining in Alberta and in Canada as a whole have been released. I examine them below.

According to the Canadian Fuels Association, the “configuration and complexity of each facility determines the types of crude oil it can process and the products it can produce.

Location and transportation infrastructure further limit the degree to which a refinery can access various types of crude and other supplies.”⁵⁹ Therefore deciding whether to increase bitumen processing in the province - or country - is not simple. Bitumen cannot be refined at just any refinery in Canada; it can only be processed at a facility that is specifically designed to handle heavy crude. In the short term refineries “must constantly juggle their choices of inputs

⁵⁸ Ibid., p. 4.

⁵⁹ Ibid., p. 5.

(crude diet) and refined outputs (product slate). In the longer term, they have to decide whether to invest in changing their configuration or shutting down.” While heavy oil is a cheaper input than lighter oil, it has higher processing costs and requires more expensive equipment.⁶⁰ The CFA writes “[s]ince the cost of crude oil is a refinery’s largest input cost, processing cheaper heavy crude into higher-value lighter products usually improves profit margins – if the refinery has the configuration to do that.”⁶¹ Yet the CFA report also cautions that as more refineries reconfigure to be able to process heavy crude, the increased demand for heavy oil as an input will narrow the price differential between heavy and light crudes, and reduce the profit margin.⁶² CFA notes a trend in refineries moving towards heavier crudes as inputs, and found that and that since 2003 these complex refineries have generated the largest profits.⁶³ The CFA’s view is that the growing fuel demand in Asia presents an opportunity for refiners of Canadian bitumen but a “substantial investment in new heavy conversion refining capacity” would be required to supply this market.⁶⁴ Given that it can take twenty to thirty years to achieve any significant return on investments in refining capacity, the CFA says the “bottom line question for prospective investors is whether new Canadian refinery capacity can profitably access and penetrate [the Asian] market over a period of 30 years or more.”⁶⁵

In 2013, Nicholas Choquette-Levy et al. conducted an integrated life cycle assessment examining the question of whether or not bitumen should be upgraded in Alberta. They argue that both economic and environmental factors must be taken into consideration by oil sands

⁶⁰ Ibid., p. 6.

⁶¹ Ibid.

⁶² Ibid.

⁶³ Ibid., p. 7, 9.

⁶⁴ Ibid., p. 15.

⁶⁵ Ibid.

producers when determining whether to upgrade bitumen or dilute it.⁶⁶ Upgrading bitumen requires large financial investments in capital and maintenance, and the intense energy use during the process releases a substantial amount of greenhouse gas emissions. The other option – diluting bitumen – is far less capital intensive, but requires a constant supply of condensate. This additive is volatile, with large price swings. SCO is far less energy intensive to refine into finished products than diluent is, meaning refiners processing diluent must invest in more advanced equipment, leading to higher costs than for the equipment needed to process upgraded bitumen (SCO).⁶⁷ The authors write the “decision of whether to upgrade therefore depends on market conditions regarding the capital costs of an upgrading facility and the future prices of diluent, SCO, and dilbit.”⁶⁸ They also acknowledge that the decision individual companies make regarding whether or not to upgrade bitumen can be affected by government actions seeking to influence the decisions of industry to “maximize benefits” for citizens, rather than shareholders.⁶⁹ In terms of environmental considerations, “a company weighing a long-term investment in upgrading or diluting bitumen is likely to include the prospect of a financial cost to its GHG emissions in its decision-making.”⁷⁰ In their analysis, Choquette-Levy et al found that under a scenario where there is no price on GHG emissions, the more profitable choice for industry is to dilute bitumen. However, this option also leads to a greater life cycle emissions of GHGs than upgrading.⁷¹ The authors acknowledge “the climate-concerned Alberta resident’s preference for upgrading may seem counter-intuitive, given the result that SCO is more GHG-

⁶⁶ Choquette-Levy, MacLean, and Bergerson, “Should Alberta upgrade oil sands bitumen,” *Energy Policy* 61 (2013), p. 79.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Ibid.

⁷⁰ Ibid., p. 81.

⁷¹ Ibid., p. 83.

intensive than the dilution” option. Albertans concerned about the climate would monetize and count emissions twice – directly as social costs, and indirectly “through the price discount assigned by refineries.”⁷² They conclude that different groups – industry, the general public, the government, and individuals concerned about the environment – will have different preferences regarding the various factors at play in the decision of whether or not to upgrade bitumen, and therefore may come to different conclusions about whether or not the amount of bitumen upgraded in the province should increase.⁷³

IHS CERA’s March 2013 report examines the economic drivers that shape decisions around whether or not to invest in bitumen processing in Alberta and how these decisions impact, among other things, job creation and government revenue. The report identifies three conditions necessary for the economics of a greenfield (new) bitumen refinery to work. These are the ability to keep capital costs to a minimum, to maximize diesel production, and to not over supply the market.⁷⁴ The CERA report also identifies two major factors that *discourage* investment in upgrading and refining, namely high construction costs and a narrow price differential between heavy and light crudes. The report challenges the argument that by shipping bitumen out of the province, Alberta is exporting jobs and economic benefits that would be kept in the province if bitumen were processed here. CERA argues that since there is a finite amount of labour available in Alberta, the construction of processing facilities puts a strain on an already tight labour market. They also argue that directing the finite amount of available labour in the province toward bitumen *producing* projects would create more jobs

⁷² Ibid., p. 84.

⁷³ Ibid., p. 85.

⁷⁴ IHS CERA, “Extracting Economic Value from the Canadian Oil Sands,” (Cambridge: IHS CERA, 2013), p.

and government revenue than directing labour toward bitumen *processing* facilities. This is because oil sands operations provide a greater number of long term jobs than processing operations, and the province does not obtain royalties from processing facilities but does from production facilities. Additionally CERA points out that because the oil sands consistently have positive returns while upgraders in Alberta tend to struggle; the government receives more income tax revenue from production as opposed to processing projects. CERA's argument is essentially that if the Alberta government's goal is to increase jobs and revenue, than encouraging an expansion in the bitumen *production* sector rather than the bitumen *processing* sector would provide the best results. The CERA study found if the bitumen processing capacity were to be increased, the most economical way to do so would be to modify existing facilities rather than through new builds. CERA predicts in the future there will be even less new investment in upgrading within Alberta because of the flat to declining demand for petroleum products in North America, the emergence of abundant tight oil reserves in North America, and the inability to get a reasonable return on the billions of capital that must be invested into a bitumen processing facility.⁷⁵

In May 2012, the House of Commons Standing Committee on Natural Resources released its report "The Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada." The report contains information gathered from various stakeholders over the course of four meetings in January and February 2012. The committee's view is that "the prospects of Canada's refining sector appear uncertain," due to declining North American

⁷⁵ Ibid., p. 20.

demand for refined fuels, especially since the 2008 recession.⁷⁶ Witnesses outlined the major economic challenges facing the Canadian refining sector as being the capital intensity of facilities, favouritism of local markets, smallness in size compared to international competitors, the heavy-light crude price differential and costs of distribution infrastructure.⁷⁷ The report places a strong emphasis on the need to view Canada's refining sector as part of a larger North American market, as well as take into account the different economic circumstances of the industry in the different regions of Canada.⁷⁸ The committee's conclusion is that due to the combination of Canadian refineries operating below capacity and the flat petroleum demand in North America and OECD countries, "there is currently no economic basis for building new refineries in Canada."⁷⁹ This position reflects the view of the current federal Conservative government, which is (for the most part) opposed to government investment in private industry.

Andrew Leach, Associate Professor at the University of Alberta's Business School and Enbridge Professor in Energy Policy, has studied the question of what the Government of Alberta should do (if anything) to encourage bitumen upgrading and refining in the province. According to Leach - an economist - a variety of factors play a role in determining whether or not upgrading in Alberta will be profitable, such as the cost of building and operating a facility, tax incentives, collaboration between extraction and upgrading operations, and the spread

⁷⁶ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 19.

⁷⁷ *Ibid.*, pp. 20-21.

⁷⁸ *Ibid.*, p. 29.

⁷⁹ *Ibid.*, p. 12.

between heavy and light oil (inputs and outputs).⁸⁰ In 2012, he estimated the cost of building a new upgrader in the province would be over \$60,000 per flowing barrel – in other words, an extremely costly endeavour.⁸¹ He calculates a company investing in such a facility would need a return on investment of over ten per cent over forty years to recoup costs; yet given the heavy-light price differential (spread) estimate of \$32 over the next ten years (even lower when coking technology is used), Leach estimates only about a six and a half per cent ROI would be possible.⁸² By his calculations, the feasibility of constructing and operating a profitable bitumen upgrader under current as well as future economic conditions are less than promising, especially considering capital costs in developing countries are much lower than in Alberta. Leach also argues that “cheaper refinery capacity built anywhere will decrease refinery margins and increase the value of our bitumen” – therefore as long as refining capacity increases in the most cost efficient way possible, no matter where the additional capacity is located, Alberta will benefit.⁸³

Leach cautions decisions regarding building bitumen processing facilities is a long term investment that cannot be based on current or short term price differentials.⁸⁴ Labour and capital costs are subject to price escalation in Alberta. This can create dramatic effects on proposed pipeline projects such as Keystone XL and Northern Gateway tending to narrow the heavy-light oil price differential. Leach argues government support of processing facilities is not

⁸⁰ Andrew Leach, “The ‘economics’ of Upgrading,” *Rescuing the frog*, February 18, 2012, <http://andrewleach.ca/oilsands/the-economics-of-upgrading/>.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Andrew Leach, “Refine it where you mine it?” *Rescuing the frog*, April 21, 2012, <http://andrewleach.ca/oilsands/refine-it-where-you-mine-it/>.

⁸⁴ Andrew Leach, “More on upgrading and refining in Alberta,” *Rescuing the frog*, March 16, 2012, <http://andrewleach.ca/uncategorized/more-on-upgrading/>.

the best solution. His position is that rather than subsidizing further upgrading of bitumen by assuming all the risk of the spread, as the government has done with the North West Upgrader, a better solution could be for the government to address the infrastructure constraints the province faces. Solving these constraints would narrow the price differential, reduce the amount by which Alberta's bitumen is discounted in the market, and increase the value received for the product.⁸⁵

The Conference Board of Canada also weighed in on the situation facing Canada's petroleum refining sector and what the future may hold. However it does need to be noted that the Conference Board was looking at Canada's refining sector as a whole, not just the heavy oil processing that this report is deals with. Its 2011 study found that while the future of Canada's upstream (extraction) sector looks profitable, including a projected continuing increase of investment in the oil sands, Canada's downstream sector faces special challenges and "economic benefits, job creation, and profits from oil refining and processing are much less assured."⁸⁶ The Conference Board identifies challenges to Canada's refining sector remaining competitive as including a weakening demand for refined petroleum products throughout North America, the growing emphasis on using renewable fuels, and a tight labour market with upward pressure on wages.⁸⁷ The report warns that without investments in Canada's aging refinery facilities, Canada's position as a net exporter of refined products is put at risk, yet these required investments are in excess of \$7 billion.⁸⁸ This figure is in the range of what an entirely new facility can cost to construct – an investment that industry currently views as too large to

⁸⁵ Ibid.

⁸⁶ Conference Board of Canada, *Canada's Petroleum Refining Sector: An Important Contributor Facing Global Challenges*, (Conference Board of Canada, 2011), p. i, 1.

⁸⁷ Ibid., p. ii.

⁸⁸ Ibid.

safely make in the present and projected future economic conditions. Another reason for this risk is that refineries in the U.S long ago invested quite heavily in reconfiguring to be able to process more heavy crude to correspond with the increasing investment in the oil sands; the Conference Board argues Canadian refiners need to do the same.⁸⁹ Environmental policy also affects the operating costs and therefore competitiveness of Canadian refiners. For example, between 2002 and 2007, refiners in Canada spent about \$5.4 billion on technology to significantly reduce the amount of sulphur in transportation fuel. The Conference Board predicts refineries “will be facing similar challenges with respect to their stack emissions, as governments are preparing to upgrade current air emissions regulations.”⁹⁰ The report also highlights the impact of a loss of refining capacity in Canada; they feel this would have a negative effect on the national economy. Using an economic impact analysis of a loss of ten per cent of Canada’s refining capacity between 2011-2015, the Conference Board estimates such a scenario would result in a loss of \$4 billion in GDP, 38,300 person years employment, and a combined reduction of federal and provincial income taxes of \$500 million and corporate taxes of \$508 million.⁹¹ As well, a loss of refining capacity would cause total net exports to decline and a decrease in investment, although spending on goods and services by the government would not be affected.⁹² The Conference Board report concludes that both direct and indirect impacts of a loss of refining capacity would be felt throughout the Canadian economy to varying degrees.

⁸⁹ Ibid., p. 9.

⁹⁰ Ibid., p. 17.

⁹¹ Ibid., pp.31-33.

⁹² Ibid., p. 33.

III. Methodology

The research for this report was gathered from a variety of sources. Academic literature on the subject of upgrading and refining capacity bitumen and related factors, especially in regards to Alberta specifically, is minimal. The Choquette-Levy et al study as well as blogging done by University of Alberta professor Andrew Leach are the most recent, and relevant, academic sources that can be found.

As a result of a lack of academic research on this subject, third party reports formed the bulk of the research and economic analysis underpinning this report. The major studies released over the past few years (all after the 2008 economic recession) focusing on upgrading bitumen or refining heavy oil in an Albertan or Canadian context were examined. These include reports from the Conference Board of Canada, The House of Commons Standing Committee on Natural Resources, IHS CERA, the Canadian Fuels Association, and the Canadian Petroleum Products Institute. These reports provide a comprehensive understanding of the economic factors that are the basis for the argument against investing in further upgrading capacity under current conditions. Few credible studies or analysis could be found supporting the argument for investing in additional bitumen upgrading capacity in the current economic conditions. This is likely due to the fact that this position is more philosophical than economic. Sources used to consolidate this aspect of the public debate is a mixture of media commentary by the major actors advocating for the position, as well as transcripts from the 2013 study of the Alberta Legislature's Standing Committee on Alberta's Economic Future examining the BRIK program.

Government of Alberta data, mainly from the Department of Energy and the Alberta Energy Regulator, was obtained for statistics on current and past upgrading and refining

capacity of bitumen in the province. As well government information on its Bitumen Royalty in Kind (BRIK) program and North West Partnership was reviewed to examine the Government of Alberta's policy to encourage more bitumen upgrading within Alberta.

The media can play a significant role in public policy debates, and there has been a significant amount news coverage regarding the issue of provincial upgrading of bitumen. News clippings focusing on this debate were reviewed, from the mid-2000s until the present day. These provide a snapshot of the major arguments being put forward in the province, as well as a perspective on where the public stands on the issue and why. Public opinion polling conducted on this topic from Ipsos Reid, ThinkHQ and CROP also gives perspective into what the general public thinks the best course of action on this file is. Since this is a public policy issue and policy and politics go hand in hand, the platforms of the various federal and provincial political parties in regards to a position on domestic upgrading of bitumen is also included.

IV. Findings

In general, there are two distinct points of view in the debate over whether or not there should be more bitumen processing within the province of Alberta. Those advocating against interventionist government policies to encourage, entice, or finance private industry to undertake more upgrading/refining of bitumen than is being facilitated by the market on its own argue that if the end goal is to build a more prosperous province through increasing the amount of skilled jobs and government revenue to fund programs and services, other policies would achieve better results. They argue that under current economic conditions, investing in new upgrading capacity cannot be profitable at the current time or into the foreseeable future. Those favouring an increase in the amount of bitumen processed within the province argue it

will lead to long term jobs and development, increased government revenues, and market and economic diversification. This section of the report examines the key arguments put forward by the two sides; both for encouraging more domestic (provincial) processing of bitumen, and letting the market determine whether or not this investment is made.

(i) Reasons for increasing the amount of bitumen upgraded within Alberta

I outline below the arguments currently (post the 2008 economic recession) being offered as to why the amount of bitumen processing in Alberta should increase.

In 2007, the Government of Alberta made the decision to take a portion of its royalties from oil sands production ‘in kind’ rather than in cash. This marked the beginning of the Bitumen Royalty in Kind program (BRIK). The rationale for this decision was that the government could “use its share of bitumen strategically to supply potential upgraders and refineries in Alberta, and to optimize its royalty share by marketing those volumes.”⁹³ According to the government, the BRIK program will add value to Albertan bitumen – in other words, more money can be made by selling upgraded bitumen products than by selling bitumen to be upgraded. BRIK has three objectives, the first being to “foster value-added oil sands development.” The government’s position is that stimulating value-added activities will bring investment and create jobs and other opportunities which will “positively impact Alberta’s long run economic sustainability and diversify the product portfolio produced in Alberta.”⁹⁴ The second objective is to “enhance the transparency and liquidity in the bitumen market.” The government’s reasoning here is that because there is a very small market for bitumen itself

⁹³ Government of Alberta, “Bitumen Royalty-in-Kind (BRIK) Frequently Asked Questions,” accessed June 22, 2014, http://www.energy.alberta.ca/About_Us/1617.asp.

⁹⁴ Government of Alberta, “Objectives and Principles of BRIK,” accessed June 22, 2014, <http://www.energy.alberta.ca/1638.asp>.

since it is mainly SCO or dilbit that is bought and sold, using BRIK to facilitate more buyers and sellers of raw bitumen will result in a more transparent market and following this, “assist Alberta in getting full value for its royalties.”⁹⁵ The last objective of BRIK is to “share in the differential gains, and risks, between synthetic crude oil (SCO) and bitumen.” According to the government, by having the province assume some of the risk – and cost – of processing, Alberta could gain more revenue in the end from marketing upgraded products than it would from taking royalties based on the price of bitumen.⁹⁶ Essentially, the government’s justification for actively assisting in generating an increase of bitumen processing inside the province is that it will increase the amount of revenue flowing to government from the resource, and create jobs within the province. Currently the only bitumen processing project that is a part of BRIK is the North West Upgrader.

The Alberta Federation of Labour, made up of twenty-nine public and private sector unions in Alberta, is one of the strongest voices in favour of increasing upgrading activity in the province. As the major labour union in the province, it is little wonder the AFL is pushing for a development that purports to add jobs. Like the government, the AFL continuously pushes the idea that more bitumen upgrading in the province means more development and more jobs. Speaking before a committee of the Legislature in February 2013, AFL spokesman Gil McGowen argued that “by shipping our bitumen raw, we’re letting literally thousands and thousands of good jobs slip through our fingers.”⁹⁷ He also argued adding additional upgrader capacity would create a larger number of permanent jobs than the amount of temporary jobs that will

⁹⁵ Ibid.

⁹⁶ Ibid.

⁹⁷ Standing Committee on Alberta’s Economic Future, committee transcript February 26, 2013, p. 68.

be created by adding new pipeline infrastructure to send bitumen to the west coast and United States.⁹⁸ He also argued the reason the provincial government could gain more revenue through upgrading is because it produces SCO which “is what the international market really wants.”⁹⁹ The AFL’s proposed role for the government is hands-on intervention in the market to stipulate more bitumen upgrading in the province, and they liken this type of action to the economic diversification initiatives (the majority of which lost money) of Premier Lougheed’s government.¹⁰⁰

Alberta’s Industrial Heartland Association (AIHA), comprised of the eight municipalities¹⁰¹ that make up the largest hydrocarbon processing area in Canada,¹⁰² take the argument for why Alberta should be processing more of its oil sands bitumen further than the standard jobs and development position (it should be noted that the livelihood of these municipalities depends upon a prosperous hydrocarbon processing industry, and therefore AIHA is far from an unbiased, objective participant in the debate). AIHA told a committee of the Legislature that the multiple benefits of upgrading in the province include “market diversification, opening up pipeline access, showing environmental leadership, and economic diversification.”¹⁰³ They argued that because bitumen can be refined only in facilities specially equipped to process heavy crude, bitumen can only be shipped to a small number of refineries and therefore upgrading it to a lighter product would diversify the number of refineries - and

⁹⁸ Ibid.

⁹⁹ Vincent McDermott, “Bitumen upgrading should be top priority: AFL,” *Fort McMurray Today*, February 27, 2013, <http://www.afl.org/index.php/AFL-in-the-News/bitumen-upgrading-should-be-top-priority-afl.html>.

¹⁰⁰ Scott Messenger, “Crude Awakening, The potential impact of the BRIK program on Alberta’s bitumen upgrading industry,” *Alberta Venture*, April 1, 2010, <http://albertaventure.com/2010/04/crude-awakening/>.

¹⁰¹ AIHL is comprised of the City of Fort Saskatchewan, Lamont County, Strathcona County, Sturgeon County, and the City of Edmonton. Associate Members are the towns of Bruderheim, Gibbons, and Redwater.

¹⁰² Located east of the City of Edmonton.

¹⁰³ Standing Committee on Alberta’s Economic Future, committee transcript February 26, 2013, p. 50.

regions - that could process it.¹⁰⁴ AIHA points out that transporting raw bitumen is actually *diluted bitumen* since diluent is added to make the bitumen liquid enough to flow through a pipe. The diluent takes up space in the pipeline (about one third) that cannot be used for bitumen, so “if you upgrade it into a light crude or even a medium crude, you don’t need the diluent, so you can utilize the full capacity of that pipeline.”¹⁰⁵ This point seems to be gaining popularity as the difficulty of approving new pipeline projects to transport Alberta bitumen increases. In terms of upgrading helping with the province’s environmental image, AIHA points to the possibility of integrating carbon capture and storage technology into new facilities to reduce emissions and combat potential international environmental regulations aimed at blocking bitumen use.¹⁰⁶ Finally, AIHA points to the \$65 billion of planned industry investments into upgrading facilities in the industrial heartland prior to the 2008 economic recession as potential for economic diversification associated with increasing the amount of in-province upgrading.¹⁰⁷

Unsurprisingly, North West Upgrading Inc., the owners of the only new upgrading project moving forward in Alberta at present, argue strongly in favor of the need to increase the amount of oil sands processing conducted within the province. The North West Upgrader is unique in that it is a bitumen refinery, and will refine raw bitumen directly into finished products such as diesel, diluent, and naphtha rather than refining upgraded bitumen feedstock. North West’s position is that processing bitumen in Alberta is less controversial than shipping bitumen to be processed elsewhere, will make Alberta less reliant on its one traditional

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid, pp. 50-51.

¹⁰⁷ Ibid, p. 51.

hydrocarbon customer, and will increase the flow of revenue to the Government of Alberta.

The major output of the North West Upgrader will be diesel, and the company argues that since there is a cyclic diesel shortage in western Canada, a reliable and predictable local market for the product exists. As well they point to demand for diesel in Asia as an opportunity to diversify to these growing markets and away from our sole customer to the south.¹⁰⁸ According to North West, transporting diesel is less controversial than transporting bitumen because a diesel spill would have less of a negative impact on the environment than a bitumen spill, and tankers moving diesel off the west coast is common and not of much concern to those local communities.¹⁰⁹ For these reasons, North West estimates transporting refined bitumen products to the west coast for trade to emerging markets is more feasible than transporting bitumen feedstock to the west coast for trade to emerging economies. In a December 2012 presentation to committee of the Alberta Legislature, North West Inc. Chairman Ian McGregor estimated that the government would receive 70 per cent more revenue from exporting a barrel of refined product than from the royalties on a barrel of bitumen.¹¹⁰ However this argument does not address the fact that the government is taking on a large amount of risk as the seller of the refined product as well as the supplier of the bitumen feedstock. Because of this, the amount of revenue received from selling finished products is less reliable and predictable than the amount of revenue the government receives from royalties (although the amount of the royalty received does depend on the market price of bitumen).

¹⁰⁸ Standing Committee on Alberta's Economic Future, committee transcript December 11, 2012, p. 27.

¹⁰⁹ Ibid.

¹¹⁰ Ibid, p. 28.

The Alberta Economic Development Authority's Transportation Committee identifies "[p]eriodic operation difficulties at [Alberta] upgraders, including more than twenty unscheduled upgrader outages since 2005" as negatively affecting both the production of SCO and associated diesel output, and contributing to the diesel and gasoline shortages throughout western Canada in recent years.¹¹¹ While AEDA recommends better coordination of maintenance schedules among downstream industry players as well as increasing provincial inventories of transportation fuels as ways to prevent further diesel shortages, it also suggests refinery expansions to bring new sources of diesel production online in the province as a potential solution. Writing in 2011, AEDA calculated both the North West Upgrader and Suncor Voyageur project (subsequently cancelled in March 2013) would produce enough diesel to prevent any shortages in Western Canada for the next ten years.¹¹² AEDA also wants the provincial government to "consider providing support and encouragement to investors in new fuel production, through additional pledges of BRIK entitlements and potentially processing agreements," to bring more refining capacity for transportation fuels online in the province to meet future demand.¹¹³ Similar to North West Upgrading Inc., the AEDA argues increasing the amount of bitumen that is refined into finished fuel products inside Alberta will benefit the local western Canadian market.

(ii) Examination of arguments for *increasing* bitumen processing within Alberta

One of the most frequent arguments put forward for expanding the amount of bitumen processing in Alberta is that it will benefit the province through the creation of "value-added"

¹¹¹ Alberta Economic Development Authority, *Fuel Shortages in Alberta And How To Fix Them*, (Calgary: Alberta Economic Development Authority, June 2011), p.1.

¹¹² *Ibid.*, p. 6.

¹¹³ *Ibid.*

jobs. Government of Alberta websites, ministers, and MLAs promote this concept as an important piece of the BRIK program and a rationale for the government's financial support of the North West Upgrader.

A question that remains unanswered is what the difference between a value-added job and any other job is. By definition, upgrading and refining jobs are manufacturing jobs. The average salary of a manufacturing job in Canada is \$53,500/year, while the average salary for oil and gas extraction jobs are nearly double that amount, at \$102,000/year.¹¹⁴ Consequently, in Alberta, working in resource extraction could add much more value to an individual's pocket book than working in resource processing. In a province with a serious labour shortage, the job creation argument simply is not enough justification for government involvement to spur the creation of jobs in an industry that industry itself is not investing in. As Andrew Leach points out, given the fact that "only 20% of oil sands sector employment is in upgrading," the "evidence that you'd have higher labour demand if you forced upgrading in a tight labour market is spotty at best."¹¹⁵ Given these realities in Alberta, the rationale of promoting bitumen processing on the basis of creating manufacturing jobs in the province is not a valid argument.

The argument that more bitumen processing will lead to economic diversification for the province of Alberta seems contradictory for several reasons. First, it is not clear there is a market for refined products coming out of Alberta, as some suggest. For example, North West Upgrading Inc. argued in front of a Legislative committee that bitumen could be fully processed in the province, with the refined petroleum products such as diesel then being shipped to the

¹¹⁴ Peter Harris, "So, how much are we earning? The average Canadian salaries by industry and region," *Workopolis*, February 1, 2014, <http://www.workopolis.com/content/advice/article/how-much-money-are-we-earning-the-average-canadian-wages-right-now/>.

¹¹⁵ Leach, "Who wins and who loses from more upgrading in Alberta?" *McLeans*, November 11, 2013, <http://www.macleans.ca/economy/economicanalysis/who-wins-and-who-loses-from-more-upgrading-in-alberta/>.

west coast for export to emerging economies. The statistical evidence seems to refute this. Asia's current demand for diesel is the second lowest it has been in sixteen years, since 1998. Due to new refining capacity that is coming online in both Asia and the Middle East, emerging economies appear to have an excess of diesel, at a time when their demand is beginning to be flat or declining. Many of these markets are expecting to export their excess diesel to other markets such as Europe; consequently it doesn't follow that they would be anxious to import diesel.

It does follow that fuel-stocks will be needed to feed the increasing number of refineries being built. Since it appears less than certain that the world's emerging economies would have the same appetite for processed fuels as they do for raw energy resources, it is worth asking whether Alberta would really be able to diversify access to markets by offering processed fuels.

It is also unclear as to whether a focus on processing bitumen is really economic diversification since it is still tied implicitly to hydrocarbons and specifically to the oil sands, the main driver of Alberta's economy. In order to process bitumen within the province there must first be extraction; processing cannot exist without extraction. The bitumen processing sector is not a way for Alberta to engage in economic diversification. As an industry it is still completely reliant upon a single natural resource and the extraction of that resource. Lastly, if upgrading and refining is not an investment the private sector views as profitable and is only feasible with government support, can it really be called "economic" when in effect it is being subsidized?

Given current economic conditions, the argument that increasing the amount of bitumen processing will increase the amount of revenue that flows to the province is not proven. It appears that new private sector investments in upgrading facilities in Alberta are

falling; the only way a project can currently be viable is with government support. Therefore all the government resources put into a project must be subtracted from the amount of revenue that will flow to the government as a result of the project. The North West Upgrader, supported by government subsidies, is being constructed and targeted to come online in 2017.

Consequently it is not possible to conduct this type analysis at the present time. The best case scenario is that the returns of a project are great enough to cover the government's investment and earn it additional revenue; the worst case scenario is the government does not recoup enough of its investment costs and loses taxpayer money. At a time when the private sector judges investment in a processing facility to be a money losing venture, why it would be any different for government is largely a rhetorical question.

The practical outcome of refining petroleum products in Alberta must also be critically taken into account.¹¹⁶ Alberta is a landlocked province in a North American market where demand for petroleum products is currently flat to declining. Even if access to the emerging economics where fuel demand is growing can be obtained, "refining economics favour local markets."¹¹⁷ This is because "the distribution of refined products over long distances and over multi-product pipelines can lead to increased sulphur levels, which requires costly remediation at the final destination."¹¹⁸ Petroleum products must also "be tailored to the climate and the regulatory requirements of the jurisdiction within which they are consumed."¹¹⁹ Therefore, refining petroleum products a long distance away from the markets they will be used in can be inefficient and costly, because "shipping refined products long distances often require

¹¹⁶ Refining into finished petroleum products, as opposed to upgrading into SCO which is still a feedstock.

¹¹⁷ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 20.

¹¹⁸ *Ibid.*

¹¹⁹ *Ibid.*, pp. 20-21.

additional refining to ensure that the product is fit for its purpose."¹²⁰ This seems to be less of an issue when a refinery is located near water for transport over tanker, as opposed to landlocked facilities. Peter Boag from the Canadian Petroleum Products Institute explains "the economies of scale of larger offshore refineries and access to ocean shipping mitigate the economic impediments of transporting finished products over long distances."¹²¹ In addition, the location of a refining facility close to the market it will supply is important because it is usually more expensive to transport the refined products to market than it is to transport feedstock to a refinery;¹²² a balance must be struck in order for a refinery to remain cost competitive. When the economics of the argument of refining finished petroleum products in Alberta are examined, there is little evidence to support new investments.

Many of the arguments for increasing the amount of bitumen upgrading and refining in Alberta appear to be based more on philosophical (some might say ideological) reasons rather than economics. The argument that is most persuasive is reflected in numbers – that the amount of revenue realized by government through the sale of refined products will be greater than the amount of revenue obtained through royalties from bitumen upon extraction – assumes a particular set of favourable economic conditions that, as outlined in the next section, is no longer the reality.

¹²⁰ Ibid., p. 21.

¹²¹ Ibid.

¹²² Canadian Fuels Association, *The Economics of Petroleum Refining*, December 2013, p. 10.

(iii) Reasons *against* increasing the amount of bitumen upgraded within Alberta

I outline below the reasons the private sector is not currently investing in increasing the capacity to upgrade bitumen within Alberta. It is important to note that industry and those who argue against increasing the amount of bitumen upgraded in the province do not appear to be *opposed* to the concept of upgrading bitumen in Alberta. Rather, based on current economic conditions, they find little feasibility for projects that create new or expand current bitumen upgrading and refining capacity to be able to operate profitably.

The major reasons deterring investment into new bitumen upgrading (and refining) capacity in the province of Alberta at this point in time is the narrow light-heavy crude price differential and high capital and labour costs. In addition, Alberta's physical location itself is not an ideal place to produce a large amount of finished petroleum products.

Heavy-Light Price Differential

The 2008 economic recession caused a sharp drop in the global demand for oil, which in turn collapsed the heavy-light crude price differential. It has remained narrow ever since, partly because heavy oil refining capacity is now greater than the availability of heavy oil feedstock, and in part because of the rapid growth of the light, sweet crude supply available in North America.¹²³ The development of shale oil (also known as tight oil) in North America, especially in the United States, is providing an abundance of light crude that is very similar to, and therefore competes with, SCO.¹²⁴ According to IHS CERA, the narrow price differential is expected to remain over the long term.¹²⁵ The continuation of a narrow price differential has a

¹²³ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 4.

¹²⁴ *Ibid.*, p. 20,

¹²⁵ *Ibid.*, p. 4.

twofold effect of increasing the time it will take to recoup the costs of the large upfront capital investment on a project, and preventing any significant difference between the price a company could receive for bitumen (heavy crude) and refined products (light crude). CERA notes that before the recession when industry was investing in new upgrading projects in the province, “a key motivation for upgrading bitumen at that time was the resulting SCO fetched a much higher price than bitumen blend.”¹²⁶ However with the current narrow price differential, that motivation has disappeared.

Confidence that a facility will make enough of a profit to offset its large up-front investment is necessary before construction of a project begins. Crude processing facilities are capital intensive to build, and it typically takes several decades to recoup initial investments. While it is impossible to completely predict future price differentials, the current narrow differential appears likely to continue long-term, further reducing this confidence. According to Professor Leach, this is because

“facilities make money on the price difference between the heavy crudes they consume and the light products they produce. The wider the price gap, the more money the facilities make and the faster they can pay back the large upfront capital investment. Conversely, if the spread between heavy crudes and light products becomes too small, profit dwindles, and the payback of the initial capital investment is put at risk.”¹²⁷

Based on the predicted average spread (between heavy oil/bitumen, and light/SCO) of about \$32.20/bbl over the next ten years,¹²⁸ Professor Leach concludes whether or not money can be made on building a new upgrader in Alberta depends on several factors, such as capital cost and other incentives that may be offered. He states

¹²⁶ Ibid., p. 1.

¹²⁷ Ibid., p. 4.

¹²⁸ Leach, “The ‘economics’ of upgrading,” *Rescuing the Frog*, February 18, 2012, <http://andrewleach.ca/oilsands/the-economics-of-upgrading/>.

“[c]apital costs for building an upgrader in Alberta are likely well-over \$60,000 per *flowing barrel* (per barrel/day of capacity), as this was Suncor’s 2008 estimate for building the 200,000 barrel per day Voyageur project. Even at a more conservative \$50,000 per barrel/day of capacity, if you want a 10% rate of return on your invested capital over a 40 year time horizon [...] you’d need to net \$15.56/bbl. A more realistic 13% rate of return over 25 years brings the capital cost up to \$20.76/bbl, and you haven’t paid to operate the upgrader yet [...] Given that heavy-light differentials are highly volatile [...] the likelihood that someone would put this sort of capital at risk unless there were significant process and/or tax/royalty advantages to doing so seems slim.”¹²⁹

Similarly, Bob Dunbar of Strategy West Inc., observes that “[a]t least based on prices in effect right now, there’s no real economic justification for upgrading because you can sell the blended bitumen at a very high price.”¹³⁰

Capital and Labour Costs

Cost is a major barrier to the construction of facilities for upgrading and refining bitumen in Alberta. “According to most analysts, the financials have been – and continue to be – the most significant barrier to significantly expanding Canada’s refining capacity. Though the precise cost of a new facility is difficult to pinpoint, some put the initial capital outlay at more than \$10 billion.”¹³¹ Since the early 2000s, cost has become even more of an issue. Between 2000 and 2008, “costs for building upgraders or refineries in Alberta increased by 70%.”¹³² For example, a project built in Alberta would cost more than double what a similar project would cost to construct on the Gulf Coast.¹³³

¹²⁹ Ibid.

¹³⁰ Messenger, “Crude Awakening, The potential impact of the BRIK program on Alberta’s bitumen upgrading industry,” *Alberta Venture*, April 1, 2010, <http://albertaventure.com/2010/04/crude-awakening/>.

¹³¹ Rachel Mendleson, “Why Aren’t We Building Refineries In Canada? Because It’s Too Late, Experts Say,” *Huffington Post*, May 24, 2012, http://www.huffingtonpost.ca/2012/05/23/canada-oil-refineries_n_1539701.html.

¹³² IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 4.

¹³³ Jackie Forrest, “Why upgrading bitumen in Alberta is a non-started,” *Alberta Oil*, September 12, 2012, <http://www.albertaoilmagazine.com/2012/09/why-upgrading-bitumen-in-alberta-is-a-non-starter/>.

The cost of labour is another factor that affects the overall upfront costs of constructing any type of facility. In North America, labour costs alone can make up thirty per cent of the total cost of a project “and labour costs in Alberta are higher than those of other regions.”¹³⁴ The province of Alberta is booming economically and the oil and gas sector offers high wages for skills that are constantly in demand such as construction. Added to this, Alberta has a skilled trade shortage, and demand often exceeds supply.¹³⁵ There is fierce competition between all types of construction projects over the finite amount of workers available at any given time. Therefore in order to find labourers in Alberta to build an upgrading or refining facility, high wages must be offered. IHS CERA argues that this scenario will have a detrimental effect on the economy, because “when construction workers are deployed to build upgraders (resulting in fewer mining or in-situ projects being built), the number of long-term jobs in the province is actually lower.”¹³⁶ They point out that

“Alberta already has more jobs than qualified people. Adding upgraders only exacerbates existing shortages. In fact, assuming that Alberta and Canada have a fixed amount of construction workers for building all oil sands projects (a good assumption based on past experience,) building upgraders actually displaces workers from other projects. At peak, it takes about 6,000 construction workers to build a 100,000-barrel-per-day upgrader. If these same workers were deployed on in situ projects, that could build 300,000 barrels per day of new bitumen production capacity over the same time period. By diverting construction workers to upgraders, Alberta is forfeiting the bitumen production, royalties, long-term jobs and taxes that would result from the lost in situ projects.”¹³⁷

¹³⁴ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 9.

¹³⁵ *Ibid.*, p. 15.

¹³⁶ *Ibid.*, p. 17.

¹³⁷ Forrest, “Why upgrading bitumen in Alberta is a non-started,” *Alberta Oil*, September 12, 2012, <http://www.albertaoilmagazine.com/2012/09/why-upgrading-bitumen-in-alberta-is-a-non-starter/>.

Alberta, which faces inclement weather, is also disadvantaged given the fact that “cold weather decreases worker productivity.”¹³⁸

Location

The physical location of Alberta is also a deterrent to attracting private investment for oil processing facilities in the province. Being a landlocked province increases construction costs. According to CERA,

“Inland locations are more expensive to build. With ocean access, larger components or modules of the facility can be built off site. Once complete, the modules can be transported to site and assembled like building blocks. This technique materially reduces the labor requirements and – consequently – the cost. Access to the ocean is critical, because modules can be the size of a football field and need to be transported by ship. Although inland locations can use this method, since the modules must be transported by truck, this materially reduces the module size and corresponding cost savings.”¹³⁹

Related to this, on-site labour demands are typically higher in landlocked areas such as Alberta, another factor that can drive up labour costs.¹⁴⁰

Alberta is not situated in a market as large as those of America or the emerging economies in Asia. Therefore, having a large enough local market to sell upgraded bitumen or refined petroleum products to poses a challenge. This is important because “[r]efining economics generally favour local markets [...] shipping refined products long distances often requires additional refining to ensure that the product is fit for its purpose.”¹⁴¹ Canada as a whole and Alberta in particular are both pursuing aggressive strategies to try to gain access to new, emerging markets to sell energy resources to. Market diversification away from having only one customer - the United States – would obviously provide economic benefits for the

¹³⁸ IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013), p. 9.

¹³⁹ *Ibid.*

¹⁴⁰ *Ibid.*

¹⁴¹ House of Commons Standing Committee on Natural Resources, *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*, (Ottawa: House of Commons, 2011), p. 21.

province and the country. However, transporting refined, and even (to an extent) upgraded, oil products to markets further away is actually more costly than transporting crude. According to Alberta Oil,

“‘Crude oil tends to move in larger vessels and it tends to be cheaper on a dollar-per-barrel basis from Canada to China or India than it is to move a barrel of [refined] product.’ Canadian producers ‘get better value monetizing crude than monetizing product in the global market.’ In other words, the poor economics of shipping refined product will only compound the problem of cost inflation at upstream projects.”¹⁴²

Other Issues

As noted earlier in this report, North America favours an integrated market operating in a global marketplace. Most Canadians probably do not even notice, or pay much attention to, the myriad of cross border transactions that are made on a daily basis which make both the Canadian and American economies stronger. Canadians certainly don’t mind the benefit of a high Canadian dollar that comes in the form of the ability to purchase goods more cheaply in the U.S than in our own country.

“The North American automobile industry is particularly illustrative of the economic implications of regional integration,”¹⁴³ meaning one of the most important sectors of the most populous province – Ontario’s auto manufacturing – relies on integration with the United States. For example, the House of Commons Standing Committee on Industry, Science, and Technology found that:

“[t]he integration of the Canadian auto sector, most notably with that of the United States and Mexico but also with that of Japan, has led to a number of milestones that a separate Canadian auto sector probably would not have achieved. For Canada, since

¹⁴² Geoffrey Morgan, “Debunking the rhetoric behind nation-building project,” *Alberta Oil*, February 4, 2014, <http://www.albertaoilmagazine.com/2014/02/debunking-nation-building-rhetoric/>.

¹⁴³ House of Commons Standing Committee on Industry, Science and Technology, *A Study of the Crisis in the Automotive Sector in Canada*, (Ottawa: House of Commons, 2009), p. 1.

1965 the benefits include a significant international presence as an auto producer and exporter and a high level of productivity, with the latter being a force for higher wages and benefits across the sector's workforce [...] But most of all, Canadians and Americans enjoy lower prices, higher quality products and greater product selection than they otherwise would."¹⁴⁴

Why then is North American integration in the form of Alberta's oil sands being processed in the United States viewed as a problem that must be solved locally? The United States currently has excess heavy oil upgrading capacity that can and wants to use Alberta bitumen as a feedstock, especially in, but not limited to, the Gulf of Mexico region. "To replace declining crude oil imports from Mexico and Venezuela, U.S. refineries are expanding and upgrading equipment to process heavier crudes, including those available from Canadian oil sands."¹⁴⁵

Based solely on project economics, if Keystone XL receives approval, the capacity to expand shipments of bitumen to these existing heavy oil refineries in the Gulf Coast will increase dramatically. When North America is viewed as an integrated market, building heavy oil upgraders in one area (at a high cost when profitability is far from guaranteed, as in the current economic climate within Alberta) is unnecessary and inefficient since enough capacity to handle the increasing extraction from the oil sands exists in another area of the market. In addition, most companies that are significant enough players in the oil sands to have integrated operations and be involved in both extraction and processing, such as CNRL, Suncor, and Shell, are worldwide corporations.

These companies do not operate solely in the oil sands, in Canada, or even with North America. Suncor, for example, mines bitumen, operates both a bitumen upgrader and refinery

¹⁴⁴ Ibid., p. 2.

¹⁴⁵ American Petroleum Institute, *The State of American Energy*, 2013, <http://www.api.org/~media/Files/Policy/SOAE-2013/SOAE-Report-2013.pdf>, p. 20.

in Alberta, and also has a share in refinery assets in the United States. Therefore if Suncor makes the business decision to extract bitumen in Alberta and then refine it in the U.S because it will be the most profitable, why should this be a cause for concern? For example, “a company can retrofit an existing U.S facility to process bitumen for 30% to 50% less than the cost of building a new one here. For an upgrader capable of processing 100,000 barrels per day (bpd), that means savings of billions of dollars.”¹⁴⁶ Many refineries in the U.S have “already made significant progress retooling to accommodate heavier crude;”¹⁴⁷ the same reconfiguration at Canadian refineries would require significant investment in new equipment, which would be redundant given the American refineries have excess capacity that can be used for Canadian crude. The success of oil sands companies provides benefits to Albertans in the form of jobs, community investments, and tax revenue to the provincial and federal governments to be spent on programs and services. Of more concern than the lifecycle of bitumen (from extraction to finished product) taking place throughout North America would be a mandate that operations must all occur within the local jurisdiction where the resource happens to be physically located, even if doing so would be less profitable than the former scenario. The result could be fewer jobs, less profits to invest back into the local and provincial community, and a decrease in revenue for both levels of government to spend on citizens. In other words – if an integrated North American market works for many industries, including Ontario’s coveted auto industry, there is no reason the same type of integration in oil processing should be viewed as negative. In order to provide further context, I now examine several case studies.

¹⁴⁶ Messenger, “Crude Awakening, The potential impact of the BRIC program on Alberta’s bitumen upgrading industry,” *Alberta Venture*, April 1, 2010, <http://albertaventure.com/2010/04/crude-awakening/>.

¹⁴⁷ Conference Board of Canada, *Canada’s Petroleum Refining Sector: An Important Contributor Facing Global Challenges*, (Ottawa: Conference Board of Canada, 2011), p. ii.

V. Case Studies

Section V examines some of the most recently proposed upgrading projects such as the North West Upgrader, Suncor's Voyageur Upgrader, and Kitimat Clean – a bitumen refinery proposal on the west coast of British Columbia. It will also examine partial upgrading, a fairly new element in the bitumen upgrading debate.

(i) North West Upgrader

The North West Upgrader, currently under construction in Sturgeon County, is the only upgrading project currently moving forward in Alberta, and it is a unique one. Not a traditional upgrader, the NWU will be the first ever bitumen refinery. Seventy-five per cent of the bitumen it will refine will be crown bitumen collected by the government of Alberta through the BRIK program. The remaining twenty-five per cent will be supplied by Canadian Natural Resources Limited (CNRL). The facility will be built in three phases, each with the capacity to process 50,000 bpd of bitumen. All phases have received regulatory approval; the first phase is currently under construction.

NWU is owned by the North West Redwater Partnership, a fifty-fifty partnership between North West Upgrading and Canadian Natural Upgrading Limited (which is a subsidiary of CNRL). The Alberta government – and therefore Alberta taxpayers – along with CNRL, are providing part of the financing and holding much of the financial risk for the project. The government's financial support of the NWU stems from the fact that the construction of a bitumen refinery in the province is a government of Alberta initiative. When the government implemented the BRIK program, the rationale was that it would "encourage upgrading, refining,

and petrochemical development” in the province.¹⁴⁸ A request for proposals for a refinery to process crown bitumen was issued, and the government chose North West’s proposal.

When construction of phase one of the NWU began in September 2013, the cost estimate for the first phase of the project was \$5.7 billion, consistent with the estimate given in November 2012 when the project received final approval. Only eleven weeks later the North West Partnership – the owners of the refinery – announced an updated cost estimate of \$8.5 billion, citing cost inflation and an inability to fully capture cost savings as reasons for the increase.¹⁴⁹ It is unclear, and we will likely never know, whether the initial figure was a poor estimate or a willful distortion. In response, the Alberta government agreed to provide \$1.5 billion in debt servicing and an additional \$300 million loan to help cover the rising capital costs. CNRL is also loaning North West \$300 million. Not only does this mean more of Albertan’s tax dollars are being used to finance the project, Albertans now hold even more financial risk by backing the NWU’s debt. If the venture is ultimately not successful and the owners cannot make a go of it, Albertans - not the North West Redwater Partnership –will hold the bill for the resulting debt.

The provincial government has taken responsibility for the financial risk of investment in the North West Upgrader. In this business case, instead of simply ensuring the NWU has a steady supply of inputs by selling it crown-owned bitumen (as was the original intention of the BRIK program), the government signed a contract under which it pays North West to refine crown bitumen, and then the government itself – through the Alberta Petroleum Marketing

¹⁴⁸ Alberta Energy, “Bitumen Royalty in Kind Background,” (Edmonton: Government of Alberta, 2010).

¹⁴⁹ North West Redwater Partnership, “North West Redwater Partnership Announces Update to Facility Cost Estimate and Certain Revisions to the Bitumen Processing Agreement,” News Release, Dec 4, 2013.

Commission – is responsible for selling the refined products on the market. Therefore the government holds all the risk that comes with the bet that a high enough market price can be fetched for refined products to cover the cost of refining and still make a profit.

Under the original Bitumen Processing Agreement, the Alberta government and CNRL signed a thirty year contract with North West to pay a toll in exchange for refining their bitumen. Professor Andrew Leach explains that this agreement means the government and Canadian Natural are “loaning part of the capital for the project to its owners, and then allowing the owners to pay them back through the tolls paid.”¹⁵⁰ In addition to providing loans and debt servicing to North West, the government and CNRL renegotiated the Bitumen Processing Agreement when the cost estimate for the project rose. The government’s annual report for 2013-2014 details how the new BPA increased toll payments to cover the higher projected capital costs. Under the original agreement, toll payments were expected to total just over \$19 billion over thirty years; the new agreement estimates toll payments to cost the government \$26 billion over the same time period.¹⁵¹

In order to determine whether the government’s financial backing of the NWU will be a good investment after coming online, it is important to establish, and use a datum of profitability. IHS CERA’s report examines the economic drivers that shape decisions around whether or not to invest in bitumen processing, and how these decisions impact, among other things, job creation and government revenue. The report identified three conditions necessary for the economics of a greenfield (new) bitumen refinery, such as the NWU, to work. These are

¹⁵⁰ Andrew Leach, “Alberta taxpayer-financed refinery: value added job creator or boondoggle?” *Macleans*, Dec 9, 2013, <http://www2.macleans.ca/2013/12/09/albertas-taxpayer-financed-refinery-value-added-job-creator-or-boondoggle-in-the-making/>.

¹⁵¹ Alberta, “2013-2014 Government of Alberta Annual Report,” (Edmonton: Government of Alberta, June 2014), p.56.

the ability to keep capital costs to a minimum, maximize diesel production, and not over supply the market.¹⁵² Measuring the NWU against this criterion, it is obvious that capital costs are not being kept to a minimum. It is unclear prior to the project coming online as to whether the other two factors will be met. While one of the major outputs of the NWU will be diesel¹⁵³, a fuel we have seen shortages of in western Canada in recent years, facilities that produce diesel require more costly equipment, and higher capital costs, than facilities that produce other outputs such as gasoline. In this regard, it is possible the capability to produce diesel may work against the criteria of keeping capital costs to a minimum.

CERA's report also identifies two major factors that discourage investment in upgrading and refining, namely high construction costs and a narrow price differential between heavy and light crudes. The NWU meets both these criteria. As mentioned, construction costs in Alberta are about thirty per cent higher than in most other jurisdictions, because of high labour costs, lower labour productivity (due to weather) and the challenge of being a landlocked province.¹⁵⁴ The high construction and capital costs typical in Alberta are resulting in NWU's construction being much more costly than originally anticipated.

(ii) Voyageur Upgrader

During the early and mid-2000s, private sector investments in new or expanded upgrading facilities in Alberta was at its height. However since the 2008 global economic recession, the landscape has changed. Table 3 provides a snapshot of the status of planned upgrading projects in the province at the time of writing. As an additional example, I discuss

¹⁵² IHS CERA, *Extracting Economic Value from the Canadian Oil Sands*, (Cambridge: IHS CERA, 2013).

¹⁵³ Other products expected to be produced include diluent, naphtha, low sulphur vacuum gas oil, and light ends such as butane, propane, and ethane.

¹⁵⁴ *Ibid.*, p. 4.

Suncor’s Voyageur Upgrader in detail to show the rationale behind the private sector’s cancellation or delay of many upgrading investments in the face of these new economic conditions.

Table 3: Proposed Bitumen Upgrader Projects in Alberta

Project	Capacity	Status	Location	Cost
CNRL Horizon	Expansion to 250,000 bpd SCO	Under construction	Fort McMurray	Unknown
North West Upgrader	150,000 bpd bitumen upgrader/diesel refinery	Phase 1 (50,000 bpd) under construction	Sturgeon County	\$8.5 B
BA Energy Heartland Upgrader	260,000 bpd diluted bitumen upgrader	Suspended 2008	Strathcona County	Unknown
Suncor Fort Hills	350,000 bpd bitumen upgrader	Suspended 2009	Sturgeon County	\$13.5 B
Statoil Canada	240,000 bpd bitumen upgrader	Withdrawn 2008	Strathcona County	\$14.4 B
Total E&P	295,000 bpd bitumen upgrader	Deferred 2010	Strathcona County	\$7-9 B
Suncor Voyageur	200,000 bpd bitumen upgrader	Cancelled 2013	Fort McMurray	\$11.6 B

In 2001 Suncor Energy, one of the largest companies operating in the oil sands, launched its Voyageur growth strategy, including plans for the construction of a third upgrader. In 2006, regulatory approval for the construction of the Voyageur upgrader was granted, following what Suncor referred to as “the most complex regulatory filing in Suncor’s history.”¹⁵⁵ Interestingly enough, at the same time, Suncor became the “first Canadian oil sands company to purchase U.S refinery assets” which it billed as “an important link to a crucial market.”¹⁵⁶ In its 2007 Annual Report, Suncor outlined the Voyageur project’s growth plans and noted the “jewel in the crown is, of course, our plan to build a third upgrader.”¹⁵⁷ At that point, the

¹⁵⁵ Suncor Energy, “2006 Annual Report,” <http://www.suncor.com/pdf/ic-annualreport2006-e.pdf>, p. 10.

¹⁵⁶ Ibid.

¹⁵⁷ Suncor Energy, “2007 Annual Report,” <http://www.suncor.com/pdf/ic-annualreport2007-e.pdf>, p. 4.

company had only spent \$1,075 million of the estimated \$11.6 billion to have the upgrader built by 2011.¹⁵⁸

In 2008, the year the recession hit full force, Suncor suspended construction of the upgrader to wait for more favourable economic conditions. The annual report from that year provides insight into the decision to halt the project.

“In October, we reduced our 2009 capital spending plans to approximately \$6 billion. But with no market correction in sight, and to ensure we are living within our means, we visited this again in early 2009, reducing capital spending further to \$3 billion. We suspended construction of the Voyageur upgrader [...] Approximately one-third of the 2009 budget has been targeted to growth projects, most of that going towards the orderly wind-down of the construction work on the Voyageur upgrader.”¹⁵⁹

Suncor put the upgrader project into “safe mode,” with undetermined resumption and completion dates.¹⁶⁰ In 2009, Suncor partnered with Total, another company which had been planning to build a new upgrading facility in Strathcona County prior to the onset of the recession. The companies explained that “[t]ogether, we are restarting construction of the 200,000 barrel per day Voyageur Upgrader [...] now slated for completion in 2016.”¹⁶¹ The partnership consisted of a fifty-one per cent share by Suncor and a forty-nine per cent interest on the part of Total.¹⁶² The new Voyageur partnership planned to re-start construction the following year (2011).¹⁶³ The rationale was that “[i]nstead of competing on separate upgraders and mine projects, Suncor and Total should be able to take a balanced approach to project work, avoiding some of the peaks and valleys of industry-wide labour demand that we would

¹⁵⁸ Ibid., p. 18.

¹⁵⁹ Suncor Energy, “2008 Annual Report,” <http://www.suncor.com/pdf/ic-annualreport2008-e.pdf>, p. 2.

¹⁶⁰ Ibid., p. 14.

¹⁶¹ Suncor Energy, “2009 Annual Report,” http://www.suncor.com/pdf/suncor_annual_report_2009_en.pdf, p. 3.

¹⁶² Ibid., p. 13.

¹⁶³ Suncor Energy, “2010 Annual Report,” <http://www.suncor.com/pdf/Suncor-English-Annual-Report.pdf>, p. 29.

otherwise have seen.”¹⁶⁴ Clearly capital costs and an uncertain economic outlook were not the only factors in the decision to collaborate on an upgrader; Alberta’s labour shortage that causes constant competition between companies in (and out of) the resource sector also played a role.

In 2011, the Voyageur Upgrader project was restarted.¹⁶⁵ However, when the economics of the project were again reviewed in 2012, the outlook was still not favourable.

Suncor’s annual report for that year explains

“economics for the Voyageur upgrader project have become challenged. The North America energy market has changed since we initially proposed building a third oil sands upgrader. Most notably, with significantly higher volumes of tight oil being produced today, there is a potential surplus of light, sweet crude on this continent. Because an upgrader takes advantage of the margin between light crudes and heavy crudes, a world with more tight oil puts the Voyageur economics on a more challenging footing.”¹⁶⁶

In March 2013, Suncor bought Total’s interest in the Voyageur Upgrader and announced the cancellation of the project, citing the changing market conditions which challenged the economics of the project as the reason for the decision.¹⁶⁷ Economic conditions were key in Suncor’s decision not to move forward with what had recently been the “crown jewel” of its oil sands growth strategy.

(iii) Kitimat Clean Bitumen Refinery

In 2012, David Black, a newspaper publisher in British Columbia, announced his intention to build a bitumen refinery on B.C’s west coast near Kitimat. Kitimat Clean Inc., a company owned by Black, originally estimated it could build a refinery with enough capacity to process all the bitumen that would be shipped through the proposed Northern Gateway

¹⁶⁴ Ibid., p. 3.

¹⁶⁵ Suncor Energy, “2011 Annual Report,” http://www.suncor.com/pdf/Suncor_annual_report_2011_en.pdf, p. 50.

¹⁶⁶ Suncor Energy, “2012 Annual Report,” http://www.suncor.com/pdf/Suncor_Annual_Report_2012_en.pdf, p. 6.

¹⁶⁷ Suncor Energy, “Suncor Energy not proceeding with Voyageur upgrader project,” March 27, 2013, <http://www.suncor.com/en/newsroom/5441.aspx?id=1702941>.

Pipeline for \$13 billion.¹⁶⁸ Currently, Kitimat Clean’s website cites the capital cost of building the refinery as \$21 billion. Kitimat Clean is now proposing to build its own oil pipeline to ship bitumen from Alberta to the refinery – which will have capacity to process 550,000 bpd of dilbit – rather than utilize the proposed Northern Gateway line.¹⁶⁹ The company projects it will receive annual revenues of \$25 billion,¹⁷⁰ and thus the media often refers to the project as a “\$25 billion refinery proposal.”

In early 2013, the Government of British Columbia hired Navigant Consulting to conduct a technical review of the Kitimat refinery proposal and assess whether the Asian market contains sufficient demand for the refinery’s products.¹⁷¹ Navigant found that locating a refinery on the west coast had economic merit, and that the amount of fuel products Kitimat Clean’s refinery would produce would be able to be consumed into Asian markets.¹⁷² At the same time, the Navigant report states that *specific* markets to which the “output of Kitimat will be targeted have not been determined” and “profitability will be dependent on market selection.”¹⁷³ Given the information available so far, Navigant concluded

“building a refinery on the coast of British Columbia has economic merit and should be considered seriously by the Government of the Province. Such a refinery would provide incremental long term economic benefits to the region, compared to export of unfinished feedstock. In addition and equally importantly, if configured carefully and managed properly, the refinery would create sustainable margins that otherwise would be lost to Asian purchasers of Canada’s oil sands production.”¹⁷⁴

¹⁶⁸ CBC News, “B.C. publisher proposes \$13B crude refinery near Kitimat,” *CBC News*, August 17, 2012, <http://www.cbc.ca/news/canada/british-columbia/b-c-publisher-proposes-13b-crude-refinery-near-kitimat-1.1276445>.

¹⁶⁹ Kitimat Clean, “Fast Facts,” accessed June 25, 2014, <http://kitimatclean.ca/fast-facts-2/>.

¹⁷⁰ *Ibid.*

¹⁷¹ Osterwald, “Review of the Proposed Kitimat Refinery Project,” (Rancho Cordova, CA: Navigant Consulting Inc., March 2013), p. 1.

¹⁷² *Ibid.*

¹⁷³ *Ibid.*, p. 15.

¹⁷⁴ *Ibid.*, p. 16.

The motive for promoting a west coast bitumen refinery may be a rebuttal or alternative to recent pipeline proposals such as Northern Gateway and the TransMountain twinning that propose transporting bitumen from Alberta to the west coast for transport via tanker to Asia. In an April 2014 editorial, Black wrote that he wanted to create jobs, increase government tax revenue, reduce greenhouse gas emissions, build a pipeline “that will never leak” and build “a modern tanker fleet that carries only refined fuels that float and evaporate if spilled. I am against shipping bitumen in tankers.”¹⁷⁵ While Kitimat Clean insists it has a strong business case and will make a profit, it is interesting that Black continuously cites environmental concerns rather than profitability as his reason for pushing the project. Black further wrote that

“[t]he Alberta oil industry’s Northern Gateway plan is to export bitumen to Asia via tankers from the B.C coast. Under no circumstances should we allow that to happen. A bitumen spill at sea could destroy our coastline, together with the fish and wildlife that depend on it, for hundreds of years [...] The solution that is best for Canada is to build a refinery in Kitimat.”¹⁷⁶

Black outlined the benefits of his project as reducing carbon emissions through the use of new technology to capture emissions and therefore being cleaner than refineries in Asia; providing 6,000 temporary jobs in B.C to construct the facility and 3,000 permanent jobs to operate it; and producing a producing light fuels that “would float and evaporate if ever spilled.”¹⁷⁷

Kitimat Clean’s website states the refinery “will produce gasoline, jet fuel and diesel fuel, primarily for export. Unlike bitumen, these refined fuels all float and evaporate if ever

¹⁷⁵ David Black, “The Kitimat refinery proposal: safe pipelines, light fuels, and B.C. jobs,” *AlberniValley News*, April 28, 2014, <http://www.alberniValleynews.com/opinion/257035721.html>.

¹⁷⁶ *Ibid.*

¹⁷⁷ *Ibid.*

spilled at sea.”¹⁷⁸ Black has even gone so far as to say “I didn’t get into this refinery business to try to make more money for myself.”¹⁷⁹

It is too soon for any information to be available that could provide evidence as to whether or not Black’s bitumen refinery might ever be constructed, or whether or not it will be profitable. Although B.C Premier Christy Clark has publicly supported the proposal,¹⁸⁰ Kitimat Clean has not yet initiated the environmental assessment process, which is required to obtain provincial regulatory approval of the project. Kitimat Clean expects to start the two year EA process this year.¹⁸¹

The investment to finance the facility has not been completely identified. The company plans to borrow \$32 billion dollars to cover capital costs of the entire project (the refinery, pipelines, and tankers). In April 2013, Kitimat Clean signed a Memorandum of Understanding with the Industrial and Commercial Bank of China (ICBC), China’s largest bank. The MOU provisions include the ICBC acting as financial advisor for the proposal and cooperating in the financing of the entire Kitimat Clean project. One stipulation is that the entirety of the refinery’s outputs be sold into Asian markets.¹⁸² Black has stated most of the financing will come from Chinese investors, leaving him with about \$6 billion to raise from within Canada.¹⁸³ He has

¹⁷⁸ Kitimat Clean, “Fast Facts,” accessed June 25, 2014, <http://kitimatclean.ca/fast-facts-2/>.

¹⁷⁹ David Black, Speech to the B.C Chamber of Commerce March 6, 2013, <http://kitimatclean.ca/vancouver-chamber-of-commerce-march-6-2013/>.

¹⁸⁰ Huffpost British Columbia, “Clark Supports \$25 Billion B.C. Refinery Deal,” *CBC News*, 03/08/2013, http://www.huffingtonpost.ca/2013/03/07/christy-clark-support-kitimat-oil-refinery_n_2832484.html.

¹⁸¹ Kitimat Clean, “Fast Facts,” accessed June 25, 2014, <http://kitimatclean.ca/fast-facts-2/>.

¹⁸² Kitimat Clean, “China’s Largest Bank To Be Part of Financing of Kitimat Clean West Coast Refinery,” April 20, 2013, <http://kitimatclean.ca/chinas-largest-bank-to-be-part-of-financing-of-kitimat-clean-west-coast-refinery/>.

¹⁸³ HuffPost British Columbia, “David Black ‘Confident’ Money In Place To Build Kitimat Refinery,” *CBC News*, December 8, 2013, http://www.huffingtonpost.ca/2013/08/12/david-black-kitimat-refinery_n_3745480.html.

requested a \$10 billion loan-guarantee from the federal government, which is far from assured.¹⁸⁴

Navigant describes the proposed Kitimat refinery as “an intriguing solution to increase the economic value of oil sands production in Alberta, while at the same time creating benefits for British Columbia.”¹⁸⁵ If Kitimat Clean can successfully build the facility and operate it profitably, it could very well provide a new model for processing bitumen in western Canada. It is possible that location close to tidewater ports will be sufficient to overcome the challenging factors deterring private industry from investing in processing facilities within Alberta at this time. As well, after the tension between Alberta and British Columbia over the proposed Northern Gateway pipeline, which has not yet fully dissipated, a project like Kitimat Clean could potentially be a cooperative way for Alberta to get its product to the Asian market, and B.C to share in some of the financial benefits.

¹⁸⁴ Kitimat Clean, “Fast Facts,” accessed June 25, 2014, <http://kitimatclean.ca/fast-facts-2/>.

¹⁸⁵ Osterwald, “Review of the Proposed Kitimat Refinery Project,” (Rancho Cordova, CA: Navigant Consulting Inc, March 2013), p. 11.

Pacific Future Energy

In June 2014, Pacific Future Energy, a consortium based in British Columbia, announced its proposal to build a \$10-billion refinery on the west coast to process bitumen into refined products for export. PFE's goal is to construct a "near-net-zero" refinery using natural gas and renewables as its fuel source, and configured with carbon capture and storage technology.

PFE says its proposed facility could eventually process one million barrels a day, and plans to seek support and /or partnerships with local B.C First Nations.

There are currently not enough public details about this latest bitumen refinery proposal to be able to further analyze its feasibility.

Source: Jones, footnote 186 below

(iv) Partial Upgrading Technology

A fairly new element in the debate about upgrading bitumen is the increasing interest and investment in partial upgrading.¹⁸⁷ As noted earlier, in order to be transported, bitumen must be made lighter and more viscous in order to flow economically. Traditionally, the two options for doing this are to upgrade bitumen into SCO, or add a diluent to turn it into dilbit. Partial upgrading offers a third option. It removes just enough residuals and impurities from raw bitumen to make it viscous enough to transport without the addition of a condensate, without removing these elements to the same extent as fully upgrading it into SCO.¹⁸⁸ Additionally, unlike complete upgrading, partial upgrading technology is suited for in-situ mining projects, where the current and projected growth in oil sands extraction is occurring.¹⁸⁹ While partial upgrading has not yet been proven to be commercially viable, several companies

¹⁸⁶ Jeffrey Jones, "B.C group pitches \$10 billion 'environmentally responsible' refinery," *Globe and Mail*, June 10, 2014, <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/bc-group-pitches-10-billion-environmentally-responsible-refinery/article19092415/>.

¹⁸⁷ Also referred to as targeted upgrading or field upgrading.

¹⁸⁸ Darren Campbell, "Field upgrading is making it possible to pipe bitumen without thinning agents," *Alberta Oil*, April 1, 2014, <http://www.albertaoilmagazine.com/2014/04/beyond-diluent/>.

¹⁸⁹ *Ibid.*

in Alberta are experimenting with pilot projects, each testing their own unique partial upgrading technologies. Table 4 details the major partial upgrading demonstration project proposals in Alberta at present.

Table 4: Proposed Partial Upgrading projects in Alberta

Proponent	Project / Technology	Capacity (bpd)	Status	Location
MEG partial Upgrader	Demonstration project, HI-Q process	1,500-3,000	2014 construction	Strathcona County
Ivanhoe Energy Tamarak	Pilot project, HTI process	34,784	Application (2017 start)	Fort McMurray
ETX Systems	Pilot plant, IYQ process	20,000	Undergoing Feasibility Study	Undisclosed
Fractal Systems	Demonstration project, Jetsear process	1,000	Testing	Provost

If partial upgrading can be commercially viable, several reasons suggest it could be a more efficient process than complete upgrading or diluting bitumen. For one, partial upgrading could prove to be a less expensive way to process bitumen than either diluting or fully upgrading it. For example, with the rapid expansion of in-situ extraction, the demand for natural gas condensate to dilute bitumen is rapidly increasing, causing a shortage of it in western Canada.¹⁹⁰ When supplies are low, the price of condensate rises, the process of making dilbit becomes more costly, and profits decrease.

Partial upgrading appears to have both lower capital and operating costs than a full upgrading facility, making it an attractive option for companies that cannot make profitable investments in a full upgrader. For example, “a partial upgrader handling 50,000 bpd could probably be built for about \$1.5 billion, compared with traditional upgraders that would cost

¹⁹⁰ Ibid.

more than \$5 billion.”¹⁹¹ Partial upgrading has been described as “a technological Holy Grail for the oil sands industry because it enables producers to achieve considerably more value for their bitumen at much lower cost than through full upgrading.”¹⁹²

Another factor that makes partial upgrading attractive is its potential to help ease the pipeline bottleneck facing Alberta. There are about a dozen proposed pipeline projects that, if completed, would add “hundreds of thousands of barrels worth of new North American capacity by 2017.”¹⁹³ Until they do however, the pipeline capacity issue will continue until these projects come online. At the same time, given the controversy over major projects such as Northern Gateway and Keystone XL, there is no guarantee that proposed pipelines will actually be constructed.

Since one barrel of dilbit contains three quarters bitumen and one-quarter condensate,¹⁹⁴ part of the capacity in a pipeline transporting dilbit is used up by the condensate, which then needs to be removed from the bitumen upon arrival at its destination. Therefore using this process reduces pipeline capacity and increases cost. Partial upgrading does not require a condensate to be blended in with bitumen; transporting partially upgraded bitumen via pipeline would free up the pipeline capacity currently being used by dilbit condensate.

¹⁹¹ Dave Cooper, “MEG’s crude project unique,” *Edmonton Journal*, February 16, 2013, <http://www2.canada.com/edmontonjournal/news/business/story.html?id=bf39f406-5de7-4acd-98b2-f169a0d3d782>.

¹⁹² Campbell, “Field upgrading is making it possible to pipe bitumen without thinning agents,” *Alberta Oil*, April 1, 2014, <http://www.albertaoilmagazine.com/2014/04/beyond-diluent/>.

¹⁹³ *Ibid.*

¹⁹⁴ *Ibid.*

MEG Energy estimates that with its partial upgrading technology, it can transport thirty per cent more bitumen than would be the case if it were transporting dilbit.¹⁹⁵ MEG Energy is a Canadian oil sands company involved with in-situ development and production.¹⁹⁶ As shown in Table 3, MEG's partial upgrader is the project closest to being operational in Alberta.¹⁹⁷ Its pilot plant will be the first pre-commercial partial upgrading facility, and will test the company's HI-Q technology which "removes both the diluent and some of the asphaltenes and resins."¹⁹⁸ Cost estimates for the testing facility stand at \$103.5 million.¹⁹⁹ In 2012, MEG received \$10 million in funding from the Alberta government's Climate Change and Emissions Management Fund on the basis that its partial upgrader will emit forty-three per cent less carbon than a standard upgrading process.²⁰⁰ By contrast, Ivanhoe Energy, a company that has been experimenting with partial upgrading for nine years, lost \$33.5 million over nine months in 2013. However, the company is now confident it can economically process at least 10,000 bpd.²⁰¹ While the success of partial upgrading is not yet guaranteed, the interest of multiple companies to invest in bringing the process into commercial viability suggests it has promise.

Alberta Innovates – Energy and Environmental Solutions (AL-EES), highlights the benefits of partial upgrading projects as reducing the province's dependence on diluents, reducing carbon emissions, providing a way for upgrading to be done economically thereby increasing

¹⁹⁵ Cooper, "MEG's crude project unique," *Edmonton Journal*, February 16, 2013, <http://www2.canada.com/edmontonjournal/news/business/story.html?id=bf39f406-5de7-4acd-98b2-f169a0d3d782>.

¹⁹⁶ MEG Energy, "About MEG," accessed June 26, 2014, <http://www.megenergy.com/about-us/about-meg>.

¹⁹⁷ Partial upgrading is also being tested in other jurisdictions such as Ecuador, Texas, and Wyoming.

¹⁹⁸ Cooper, "MEG's crude project unique," *Edmonton Journal*, February 16, 2013, <http://www2.canada.com/edmontonjournal/news/business/story.html?id=bf39f406-5de7-4acd-98b2-f169a0d3d782>.

¹⁹⁹ *Ibid.*

²⁰⁰ *Ibid.*

²⁰¹ *Ibid.*

local upgrading and associated jobs, adding value to bitumen, and increasing profits for in-situ producers.²⁰² The AI-EES projects the benefits of partial upgrading to be nearly identical to the benefits outlined by those arguing for an increase in full upgrading in the province. It follows that if partial upgrading proves to be a successful processing method, those advocating for more upgrading projects in Alberta to add value to our bitumen would champion partial upgrading. It also follows that if partial upgrading really does prove to be a more cost-effective option than either diluting or fully upgrading bitumen, more oil sands operators, especially those with in-situ operations, will switch to this process.

VI. Public Opinion

The withdrawal of billions of dollars of industry investment into bitumen processing facilities since the economic recession has put pressure on the Alberta government. As I outline in the report, various stakeholders are calling on the government to take action to bring the jobs and provincial revenue associated with these investments back into the province. This is significant, because public opinion plays a major role in shaping government policy, yet it is not always informed by economic facts. This is demonstrated by the fact that despite the economic conditions that have led the oil industry to cancel or postpone most planned upgrading projects, the majority of Albertans as well as Canadians continue to support local processing of bitumen. The Canadian Fuels Association explains that the

“debate over finding new markets for Canada’s growing crude supply carries over into the refining sector. Some Canadians suggest, indeed expect, that with increasing crude production, Canada’s refining capacity should also grow. They ask why aren’t we

²⁰² Alberta Innovates – Energy and Environment Solutions, “2011-2012 Annual Report,” June 29, 2012, http://ai-ees.ca/media/9762/2012annual_report_template_combined_final.pdf, p. 11.

refining more of our oil in Canada, and could we not get more value from our petroleum resources from more value added activity.”²⁰³

In December 2011, eighty-four per cent of Albertans polled by ThinkHQ indicated they felt it is important that oil sands be upgraded in the province, with seventy per cent going further and expressing support for an *increase* in upgrading and refining in Alberta.²⁰⁴ An April 2012 Ipsos Reid poll found eighty per cent of Canadian residents in favour of placing a priority on refining Canadian oil in Canada, ahead of refining imported oil.²⁰⁵ Support from Albertans was the highest in the country at eighty-eight per cent.²⁰⁶ A CROP poll conducted in September 2013 asked if “Canada should try to process more of our natural resources in Canada before they are exported,” to which seventy-eight per cent of Canadians polled responded yes, with a matching percentage of support among western Canadians.²⁰⁷ The most recent poll conducted on this subject, commissioned by the Alberta Industrial Heartland Association, found that seven in ten Albertans would like to see the amount of bitumen upgraded in the province increase.²⁰⁸

ThinkHQ’s public opinion research found “eighty-one percent of Albertans feel that the government should be taking steps to increase the amount of oilsands upgrading and refining provincially.”²⁰⁹ This helps explain why political parties across the ideological spectrum, at both

²⁰³ Canadian Fuels Association, *The Economics of Petroleum Refining: Understanding the business of processing crude into fuels and other value added products*, December 2013, p. 3.

²⁰⁴ Marc Henry, “The politics of upgrading Alberta bitumen,” *Calgary Herald*, January 26, 2012, <http://www2.canada.com/calgaryherald/news/story.html?id=57f21256-4275-4386-bb76-c25794ea2d76&p=2>.

²⁰⁵ Ipsos Reid, “Views on Canadian Oil and Gas,” May 3, 2013, <http://www.ipsos-na.com/news-polls/pressrelease.aspx?id=5614>.

²⁰⁶ Ibid.

²⁰⁷ Canada West Foundation, “Survey: Canada and its Natural Resources,” October 2013, http://cwf.ca/pdf-docs/publications/Canada%20and%20its%20Natural%20Resources_October2013.pdf, p. 17.

²⁰⁸ Sheila Pratt, “Majority of Albertans support bitumen upgrading incentives: poll,” *Edmonton Journal*, July 2, 2014, <http://www.edmontonjournal.com/Majority+Albertans+support+bitumen+upgrading+incentives+poll/9994957/story.html>.

²⁰⁹ Henry, “The politics of upgrading Alberta bitumen,” *Calgary Herald*, January 26, 2012, <http://www2.canada.com/calgaryherald/news/story.html?id=57f21256-4275-4386-bb76-c25794ea2d76&p=2>.

the provincial and federal levels, periodically express policy support for more upgrading and refining of the oil sands in Alberta, or at least in Canada. In the 2008 federal election, the Conservative Party of Canada promised to prohibit the export of raw bitumen outside Canada for upgrading in higher polluting jurisdictions.²¹⁰ This election promise was widely regarded as implying that more upgrading would be undertaken within Canada, but no government policy was ever enacted despite a Conservative party win in 2008 and again in 2011. The federal NDP, while in favour of slowing the growth of the oil sands, consistently speak of adding value to bitumen before exporting it outside Canada. Interestingly the Liberal Party of Canada has no policy regarding domestic upgrading and refining, although its leader recently stated he would reverse the decision to approve the Northern Gateway pipeline if elected, indicating opposition to the exportation of bitumen.

As noted earlier, the Progressive Conservative government of Alberta, through its BRIK program, has been trying to encourage more upgrading in the province by providing incentives for companies that are not necessarily involved in upstream oil sands development to construct merchant bitumen upgraders. In 2006, the government “announced it would seek to increase the proportion of bitumen that is upgraded in Alberta, out of a desire to increase the number of local high-paying jobs that stem from developing the province’s resources.”²¹¹ However, to date only one project is underway, and it is only moving forward due to government provision of part of the financing, and government assumption of risk. Alberta’s Wildrose party, which became the Official Opposition after the 2012 provincial election, supports the upgrading of

²¹⁰ Conservative Party of Canada, “The True North Strong and Free Stephen Harper’s plan for Canadians,” 2008, p. 23.

²¹¹ Choquette-Levy, MacLean, and Bergerson, “Should Alberta upgrade oil sands bitumen? An integrated life cycle framework to evaluate energy systems investment tradeoffs,” *Energy Policy* 61 (2013), p. 79.

bitumen in the province but only if it is “economically viable.”²¹² Wildrose consistently criticizes the government for providing taxpayer funding to industry projects, such as the North West Upgrader of which CNRL, a major Canadian oil company, is also a partner. The Alberta Liberals are broadly in favour of increasing bitumen upgrading inside the province. During the last provincial election, Liberal leader Raj Sherman stated his party supports “a balanced approach to further upgrading in Alberta where it is economically viable and environmentally responsible.”²¹³ The Alberta New Democrats go much further – their policy states an NDP government would “require all new oilsands developments to have plans for upgrading in Alberta” as well as “develop a differential royalty system on bitumen and upgraded products that encourages value added in Alberta.”²¹⁴

Support for government action to increase oil sands upgrading and refining in the province appears to be highest among people who said they would vote PC or Wildrose – eighty-seven per cent - with only twenty per cent support among Albertans who tend to vote NDP.²¹⁵ ThinkHQ also questioned Albertans about specific policy tools that could be used to encourage more local processing. The results indicate seventy-three per cent favor further royalties levied on exported raw bitumen, fifty-six per cent support tax incentives to encourage private investment, and forty-nine per cent agreed with government loan guarantees for companies building new upgraders or refineries.²¹⁶ The majority of Albertans appear to oppose

²¹² Duncan Kinney, “The Wildrose Party – Danielle Smith,” *Alberta Venture*, April 17, 2012, <http://albertaventure.com/2012/04/the-wildrose-party-danielle-smith/>.

²¹³ Duncan Kinney, “The Alberta Liberal Party – Raj Sherman,” *Alberta Venture*, April 17, 2012, <http://albertaventure.com/2012/04/the-alberta-liberal-party-raj-sherman/>.

²¹⁴ Alberta New Democrats, “Making Oil Sands Prosperity Work for All Albertans,” http://albertandp.ca/assets/andp_common/issues/Priority_Points_Oil_Sands_2.pdf.

²¹⁵ *Ibid.*

²¹⁶ *Ibid.*

government subsidies to private companies for the operating or capital costs of constructing an upgrading facility, and “are split right down the middle on the prospect of creating a Crown corporation to build and operate Alberta upgrading and refining facilities.”²¹⁷ AIHA’s poll, released July 2014, found seventy per cent of Albertans polled were in favour of tax incentives to increase bitumen upgrading inside the province, seventy-two per cent support for government and industry partnerships, and sixty per cent approval for reducing royalty payments for companies that choose to upgrade bitumen inside Alberta.²¹⁸ Three quarters of respondents felt government does have a role to play in making more provincial upgrading of bitumen a reality.²¹⁹

As I point out above, political party policies support local upgrading to varying degrees. The interesting thing is that if bitumen upgrading in Alberta was economically viable, industry would be investing in it. If the economics of upgrading and refining were clearly sound, as they were in the early 2000s, companies would be investing in these operations. However, public opinion – and the government policy and political party positions shaped by this opinion – typically does not change as swiftly as economic conditions.

VII. Policy

(i) Current Government of Alberta Policy re: Upgrading

The Government of Alberta has had an official policy to encourage bitumen processing within the province since the launch of the BRIK program in 2008. Originally intended to simply provide a long term (30 year) secure source of bitumen feedstock to merchant upgraders as an

²¹⁷ Ibid.

²¹⁸ Pratt, “Majority of Albertans support bitumen upgrading incentives: poll,” *Edmonton Journal*, July 2, 2014, <http://www.edmontonjournal.com/Majority+Albertans+support+bitumen+upgrading+incentives+poll/9994957/story.html>.

²¹⁹ Ibid.

incentive for companies to invest in these facilities, it has spiraled into a patchwork of ad hoc government decisions made in response to changing economic conditions. These government actions now constitute a provincial government policy of providing capital loans and assuming project risk of what is technically a bitumen processing plant that is still technically a private facility.

As recently as June 2014, interim Premier Dave Hancock reaffirmed the government's commitment to see two-thirds of the bitumen produced in Alberta upgraded in the province.²²⁰ Premier Hancock stated "We have a policy that 66 per cent of the bitumen will be upgraded here at home" and noted "it's getting harder and harder to achieve that."²²¹ He also acknowledged that if the government's policy is to be met, "we have to look at the marketplace and say, 'Where is the appropriate way for government to intervene in this – if it is appropriate to intervene?' It won't happen unless we do that in some way – as we did with the North West upgrader."²²² Premier Hancock mused that the most effective way of encouraging more local upgrading could be to apply accelerated capital cost allowances²²³ to stabilize the large financial risk of such investments.²²⁴ However, the government does not appear to have any formal policy in this regard; the Premier stated only that the province would have to speak with the federal government about it.

²²⁰ Pat Roche, "Accelerated Capital Cost Allowance might spur more upgrading: Hancock," *Daily Oil Bulletin*, June 11, 2014.

²²¹ *Ibid.*

²²² *Ibid.*

²²³ Leach, "Alberta taxpayer-financed refinery: value added job creator or boondoggle?" *Macleans*, Dec 9, 2013 <http://www2.macleans.ca/2013/12/09/albertas-taxpayer-financed-refinery-value-added-job-creator-or-boondoggle-in-the-making/>.

²²⁴ Roche, "Accelerated Capital Cost Allowance might spur more upgrading: Hancock," *Daily Oil Bulletin*, June 11, 2014.

(ii) Implications of current Government of Alberta Policy

By the end of 2006, there were seven upgrading projects planned in Alberta, totaling about \$75 billion in capital investments alone.²²⁵ Today, the only project moving forward is the one with significant government support, including financial support. It is also the only bitumen processing facility under the BRIK program.²²⁶ This has important implications for the future of BRIK. If the government plans to put out future RFPs for additional facilities to process crown bitumen in the province, it is difficult to imagine any company being interested if the program offers anything less than the very generous support given to the NWU. Yet if future economic conditions play out as projected, industry has little incentive to invest in either building new, or expanding existing, upgraders in Alberta because the financial risks are greater than the potential gains. It would appear that if the government is serious about meeting its target of sixty-six per cent of the bitumen extracted also being upgraded in the province, it will have to take further action. If this occurs, the continuation of BRIK will lead to even more government intervention in the market, and despite the fact that the majority of the public supports local processing of bitumen (without knowing all the facts), Albertans also typically do not look favourably on government being in the business of being in business.

VIII. Conclusion

The current economic climate where the Alberta government invests in bitumen processing - and private industry does not - is one in which there is projected to be a long-term narrow heavy-light crude differential, the labour shortage the province has faced for many year

²²⁵ Messenger, "Crude Awakening, The potential impact of the BRIK program on Alberta's bitumen upgrading industry," *Alberta Venture*, April 1, 2010, <http://albertaventure.com/2010/04/crude-awakening/>.

²²⁶ BRIK is also supporting one carbon capture and storage project for enhanced oil recovery.

is continuing, the demand for refined petroleum products in North America is flat to declining, and Canada's refining sector as a whole is not operating at full capacity. These factors make investments into bitumen processing facilities very uncertain; investments are long term and the current and projected economic conditions do not indicate profitability. Add to this the fact that there are both heavy oil upgraders in the Gulf and oil refineries in other areas of Canada with excess capacity oil sands bitumen can utilize, and all indications are that it does not currently make economic sense to invest in additional upgrading and refining capacity within Alberta.

The philosophical arguments for increasing provincial bitumen processing fail to hold up as well. As shown in this study, advocates for more upgrading/refining in the province assume a certain amount of jobs and revenue will not be generated in the province unless we "add value" to our bitumen. In Alberta, with a tight labour market and skilled worker shortage, bitumen processing jobs compete with higher paying resource extraction jobs. Both extraction and processing operations contribute tax revenue to the provincial government (through personal and corporate income tax); only extraction operations also send royalty revenue to the provincial treasury. Directing strained labour resources towards processing facilities and away from extraction operations may therefore actually decrease the amount of revenue received by government.

IX. Recommendations

The Government of Alberta's policy regarding in-province bitumen processing has been inconsistent and reactionary since the creation and implementation of the BRIK program. It has not increased the percentage of bitumen processed in the province; the North West Upgrader,

after all construction phases are complete, will only refine 150,000 bpd of bitumen - a drop in the bucket compared to the 1.7 million bpd of bitumen produced by the oil sands in 2012.²²⁷ Albertans benefiting from additional jobs or revenue fail to benefit as well; taxpayer money is funding the only current addition of bitumen refining capacity and the province holds the bulk of the project's financial risk. The government's current policy is failing Albertans.

Below, I provide three policy recommendations to the Government of Alberta for ways in which to take action on this file for the benefit of the province. Unlike current government policy, these recommendations are grounded in the current and projected economic conditions facing both the province and the North American market of which it is an integral component.

1. Scrap BRIK – plan for the future.

The government should focus on planning for the future rather than react to the market with ad hoc decisions. The government should end the BRIK program and take time to plan ahead with measures that will help the processing sector become more competitive.

The government has been inconsistent with its policy, making ad hoc decisions such as providing financial capital to the BRIK program's only bitumen processing facility as a reaction to changing market conditions. Rather than pause to analyze the current and future economic scenario and make policy adjustments accordingly, the government is stubbornly ploughing ahead with a policy that is failing, and putting taxpayers at risk while doing so.

The government should scrap BRIK before it requires further government expenditures, which appears likely given the projected continuation of high labour costs and a narrow heavy-light crude price differential. Instead, the government should undertake a long-term economic

²²⁷ Canadian Association of Petroleum Producers, "Basic Statistics," <http://www.capp.ca/library/statistics/basic/Pages/default.aspx>.

analysis and consult with industry regarding measures that could assist the current players in bitumen processing in Alberta to remain competitive in the North American market.

2. Address infrastructure constraints

The government should focus on addressing infrastructure constraints to open up access to new customers for bitumen in the emerging markets with increasing demand for petroleum products.

As this report shows, it is not clear, especially under current economic circumstances, that increasing bitumen processing within Alberta will enable the province to fetch a higher price for our bitumen by “adding value” to it. A policy that will better facilitate a higher price for bitumen is one that promotes access to world markets.

As a practical matter though, actions cannot be undertaken by private industry, citizens, and organizations with the same impact as government policies or programs. This is where the government can and should focus and play a role. For example, the provincial government is in a position to put pressure on governments in others at the highest level to support key infrastructure projects such as oil pipelines. It is the provincial government that can build public support through stringent oversight in the project approval process and enforcement of safety and environmental regulations. It is the provincial government who should be communicating to the public about how market access will increase the revenue we can receive for our bitumen and doing whatever it can to contribute to the ability of industry to build infrastructure that will ease the current transportation constraints the oil sands face.

3. Invest in new technology such as partial upgrading

The government should focus any expenditures on this file on investments in technology to assist the bitumen processing sector with maintaining competitiveness.

The Alberta government is already investing in partial upgrading, providing MEG's project with \$10 million in funding. In order to avoid picking "winners and losers," the government should set up an innovation fund of a fixed sum for projects meeting a specific set of criteria. The criteria should be along the lines of innovation in processing bitumen into a transportable crude, but not as specific as only including partial upgrading processes. The government must be strict about a fixed fund to avoid providing a subsidy forever; as soon as a technology become commercially viable, it should no longer receive any form of government funding.

Bibliography

- Alberta. "2013-2014 Government of Alberta Annual Report." Edmonton: Government of Alberta, June 2014.
- Alberta. "Bitumen refinery agreement promotes value-added development." February 16, 2011.
- Alberta. "Bitumen Royalty-in-Kind (BRIK) Frequently Asked Questions." Accessed June 22, 2014. http://www.energy.alberta.ca/About_Us/1617.asp.
- Alberta. "Objectives and Principles of BRIK." Accessed June 22, 2014. <http://www.energy.alberta.ca/1638.asp>.
- Alberta Economic Development Authority. *Fuel Shortages in Alberta And How To Fix Them*. Calgary: Alberta Economic Development Authority, June 2011.
- Alberta Energy. "Agreement to Process Crown Royalty Bitumen." February 16, 2011. <http://www.energy.alberta.ca/Org/pdfs/BRIKagreement2Process.pdf>.
- Alberta Energy. "Bitumen Royalty in Kind Backgrounder." Edmonton: Government of Alberta, 2010.
- Alberta Energy. "Energy's History in Alberta." Accessed May 1, 2014. http://www.energy.alberta.ca/About_Us/1133.asp.
- Alberta Energy. "Upgrading and Refining." Last modified February 10, 2014. <http://www.energy.alberta.ca/Oil/pdfs/FSRefiningUpgrading.pdf>.
- Alberta Energy Regulator. *ST98-2014: Alberta's Energy Reserves 2013 and Supply/Demand Outlook 2014–2023*. Calgary: Alberta Energy Regulator, 2014.
- Alberta's Industrial Heartland. "Bitumen Royalty in Kind Program." accessed June 26, 2014. http://www.industrialheartland.com/index.php?option=com_content&task=view&id=142&Itemid=0.
- Alberta Innovates – Energy and Environment Solutions. "2011-2012 Annual Report." June 29, 2012. http://ai-ees.ca/media/9762/2012annual_report_template_combined_final.pdf.
- Alberta New Democrats. "Making Oil Sands Prosperity Work for All Albertans." http://albertandp.ca/assets/andp_common/issues/Priority_Points_Oil_Sands_2.pdf.
- American Petroleum Institute. *The State of American Energy*. 2013. <http://www.api.org/~media/Files/Policy/SOAE-2013/SOAE-Report-2013.pdf>,

- Andrews, Anthony, Robert Pirog, and Molly F. Sherlock. "The U.S Oil Refining Industry: Background in Changing Markets and Fuel Prices." Washington: U.S Congressional Research Service, 2010.
- Black, David. "The Kitimat refinery proposal: safe pipelines, light fuels, and B.C. jobs." *AlberniValley News*, April 28, 2014. <http://www.alberniValleynews.com/opinion/257035721.html>.
- Black, David. Speech to the B.C Chamber of Commerce. March 6, 2013. <http://kitimatclean.ca/vancouver-chamber-of-commerce-march-6-2013/>.
- Campbell, Darren. "Field upgrading is making it possible to pipe bitumen without thinning agents." *Alberta Oil*, April 1, 2014. <http://www.albertaoilmagazine.com/2014/04/beyond-diluent/>.
- Campbell, Darren. "Partial Credit: Four Alberta companies that are upgrading bitumen differently." *Alberta Venture*, April 21, 2014. <http://albertaventure.com/2014/04/partial-credit/>.
- Canada West Foundation. "Survey: Canada and its Natural Resources." October 2013. http://cwf.ca/pdf-docs/publications/Canada%20and%20its%20Natural%20Resources_October2013.pdf.
- Canadian Association of Petroleum Producers. "Oil Sands Today – History." Accessed May 2, 2014. <http://www.oilsandstoday.ca/whatare oilsands/Pages/History.aspx>.
- Canadian Association of Petroleum Producers. "Oil Sands Today – Recovering the oil." Accessed May 2, 2014. <http://www.oilsandstoday.ca/whatare oilsands/Pages/RecoveringtheOil.aspx>.
- Canadian Fuels Association. *The Economics of Petroleum Refining: Understanding the business of processing crude into fuels and other value added products*. December 2013.
- CBC News. "B.C. publisher proposes \$13B crude refinery near Kitimat." *CBC News*, August 17, 2012. <http://www.cbc.ca/news/canada/british-columbia/b-c-publisher-proposes-13b-crude-refinery-near-kitimat-1.1276445>.
- Choquette-Levy, Nicolas, Heather L. MacLean, and Joule A. Bergerson. "Should Alberta upgrade oil sands bitumen? An integrated life cycle framework to evaluate energy systems investment tradeoffs." *Energy Policy* 61 (2013).
- Conference Board of Canada. *Canada's Petroleum Refining Sector: An Important Contributor Facing Global Challenges*. Ottawa: Conference Board of Canada, 2011.

- Cooper, Dave. "MEG's crude project unique." *Edmonton Journal*, February 16, 2013. <http://www2.canada.com/edmontonjournal/news/business/story.html?id=bf39f406-5de7-4acd-98b2-f169a0d3d782>.
- Conservative Party of Canada. "The True North Strong and Free Stephen Harper's plan for Canadians." 2008.
- Crowley, Brian Lee. "Markets hunger for Canadian bitumen, not refined oil." *Globe & Mail*, October 3, 2013. <http://www.theglobeandmail.com/report-on-business/economy/economy-lab/markets-hunger-for-canadian-bitumen-not-refined-oil/article14688599/>.
- Forrest, Jackie. "Why upgrading bitumen in Alberta is a non-starter." *Alberta Oil*, September 12, 2012. <http://www.albertaoilmagazine.com/2012/09/why-upgrading-bitumen-in-alberta-is-a-non-starter/>.
- Gray, Murray R. "Tutorial on Upgrading of Oil Sands Bitumen." University of Alberta, Department of Chemical and Materials Engineering. <http://www.ualberta.ca/~gray/Links%20&%20Docs/Web%20Upgrading%20Tutorial.pdf>.
- Harris, Peter. "So, how much are we earning? The average Canadian salaries by industry and region." *Workopolis*, February 1, 2014. <http://www.workopolis.com/content/advice/article/how-much-money-are-we-earning-the-average-canadian-wages-right-now/>.
- Henry, Marc. "The politics of upgrading Alberta bitumen." *Calgary Herald*, January 26, 2012. <http://www2.canada.com/calgaryherald/news/story.html?id=57f21256-4275-4386-bb76-c25794ea2d76&p=2>.
- House of Commons Standing Committee on Industry, Science and Technology. *A Study of the Crisis in the Automotive Sector in Canada*. Ottawa: House of Commons, 2009.
- House of Commons Standing Committee on Natural Resources. *Current and Future State of Oil and Gas Pipelines and Refining Capacity in Canada*. Ottawa: House of Commons, 2011.
- Huffpost British Columbia. "Clark Supports \$25 Billion B.C. Refinery Deal." *CBC News*, 03/08/2013. http://www.huffingtonpost.ca/2013/03/07/christy-clark-support-kitimat-oil-refinery_n_2832484.html.
- HuffPost British Columbia. "David Black 'Confident' Money In Place To Build Kitimat Refinery." *CBC News*, December 8, 2013. http://www.huffingtonpost.ca/2013/08/12/david-black-kitimat-refinery_n_3745480.html.
- IHS CERA. *Extracting Economic Value from the Canadian Oil Sands*. Cambridge: IHS CERA, 2013.

Ipsos Reid. "Views on Canadian Oil and Gas." May 3, 2013. <http://www.ipsos-na.com/news-polls/pressrelease.aspx?id=5614>.

Jones, Jeffrey. "B.C group pitches \$10 billion 'environmentally responsible' refinery." *Globe and Mail*, June 10, 2014. <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/bc-group-pitches-10-billion-environmentally-responsible-refinery/article19092415/>.

Kinney, Duncan. "The Alberta Liberal Party – Raj Sherman." *Alberta Venture*, April 17, 2012. <http://albertaventure.com/2012/04/the-alberta-liberal-party-rai-sherman/>.

Kinney, Duncan. "The Wildrose Party – Danielle Smith." *Alberta Venture*, April 17, 2012. <http://albertaventure.com/2012/04/the-wildrose-party-danielle-smith/>.

Kitimat Clean. "China's Largest Bank To Be Part of Financing of Kitimat Clean West Coast Refinery." April 20, 2013. <http://kitimatclean.ca/chinas-largest-bank-to-be-part-of-financing-of-kitimat-clean-west-coast-refinery/>.

Kitimat Clean. "Fast Facts." Accessed June 25, 2014. <http://kitimatclean.ca/fast-facts-2/>.

Leach, Andrew. "Alberta taxpayer-financed refinery: value added job creator or boondoggle?" *Macleans*, Dec 9, 2013. <http://www2.macleans.ca/2013/12/09/albertas-taxpayer-financed-refinery-value-added-job-creator-or-boondoggle-in-the-making/>.

Leach, Andrew. "More on upgrading and refining in Alberta." *Rescuing the frog*, March 16, 2012. <http://andrewleach.ca/uncategorized/more-on-upgrading/>.

Leach, Andrew. "Refine it where you mine it?" *Rescuing the frog*, April 21, 2012. <http://andrewleach.ca/oilsands/refine-it-where-you-mine-it/>.

Leach, Andrew. "The 'economics' of Upgrading." *Rescuing the frog*, February 18, 2012. <http://andrewleach.ca/oilsands/the-economics-of-upgrading/>.

Leach, Andrew. "Who wins and who loses from more upgrading in Alberta?" *Macleans*, November 11, 2013. <http://www.macleans.ca/economy/economicanalysis/who-wins-and-who-loses-from-more-upgrading-in-alberta/>.

Lewis, Jeff. "How upgrader plants are giving way to new oil sands technologies." *Financial Post*, January 1, 2014. http://business.financialpost.com/2014/01/01/how-upgrader-plants-are-giving-way-to-new-oil-sands-technologies/?_lsa=8c45-8206.

McDermott, Vincent. "Bitumen upgrading should be top priority: AFL." *Fort McMurray Today*, February 27, 2013. <http://www.afl.org/index.php/AFL-in-the-News/bitumen-upgrading-should-be-top-priority-afl.html>.

MEG Energy. "About MEG." Accessed June 26, 2014, <http://www.megenergy.com/about-us/about-meg>.

Mendleson, Rachel. "Why Aren't We Building Refineries In Canada? Because It's Too Late, Experts Say." *Huffington Post*, May 24, 2012. http://www.huffingtonpost.ca/2012/05/23/canada-oil-refineries_n_1539701.html.

Messenger, Scott. "Crude Awakening, The potential impact of the BRIK program on Alberta's bitumen upgrading industry." *Alberta Venture*, April 1, 2010. <http://albertaventure.com/2010/04/crude-awakening/>.

Moore, M.C, S. Flaim, D. Hackett, S. Grissom, D. Crisan, and A. Honavar. "Catching the Brass Ring: Oil Market Diversification Potential for Canada." *University of Calgary, School of Public Policy* Vol. 4 Issue 16, December 2011.

Morgan, Geoffrey. "Debunking the rhetoric behind nation-building project." *Alberta Oil*, February 4, 2014. <http://www.albertaoilmagazine.com/2014/02/debunking-nation-building-rhetoric/>.

North West Redwater Partnership. "North West Redwater Partnership Announces Update to Facility Cost Estimate and Certain Revisions to the Bitumen Processing Agreement." News Release, Dec 4, 2013.

Osterwald, Edward. "Review of the Proposed Kitimat Refinery Project." (Rancho Cordova, CA: Navigant Consulting Inc., March 2013).

Pratt, Sheila. "Majority of Albertans support bitumen upgrading incentives: poll." *Edmonton Journal*, July 2, 2014. <http://www.edmontonjournal.com/Majority+Albertans+support+bitumen+upgrading+incentives+poll/9994957/story.html>.

Roche, Pat. "Accelerated Capital Cost Allowance might spur more upgrading: Hancock." *Daily Oil Bulletin*, June 11, 2014.

Standing Committee on Alberta's Economic Future. Committee transcript December 11, 2012.

Standing Committee on Alberta's Economic Future. Committee transcript February 26, 2013.

Suncor Energy. "2006 Annual Report." <http://www.suncor.com/pdf/ic-annualreport2006-e.pdf>.

Suncor Energy. "2007 Annual Report." <http://www.suncor.com/pdf/ic-annualreport2007-e.pdf>.

Suncor Energy. "2008 Annual Report." <http://www.suncor.com/pdf/ic-annualreport2008-e.pdf>.

Suncor Energy. "2009 Annual Report."

http://www.suncor.com/pdf/suncor_annual_report_2009_en.pdf.

Suncor Energy. "2010 Annual Report." <http://www.suncor.com/pdf/Suncor-English-Annual-Report.pdf>.

Suncor Energy. "2011 Annual Report."

http://www.suncor.com/pdf/Suncor_annual_report_2011_en.pdf.

Suncor Energy. "2012 Annual Report."

http://www.suncor.com/pdf/Suncor_Annual_Report_2012_en.pdf.

Suncor Energy. "Suncor Energy not proceeding with Voyageur upgrader project." March 27, 2013. <http://www.suncor.com/en/newsroom/5441.aspx?id=1702941>.

U.S Energy Information Administration. "Number and Capacity of Petroleum Refineries."

Accessed May 3, 2014. http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm.