

Northern Alliance *of* INDEPENDENT PRODUCERS

April 3, 2006

Karlene Fine
North Dakota Industrial Commission
600 East Boulevard Avenue
State Capitol
Bismarck, North Dakota, 58505

Re: Northern Alliance grant application for research transportation capacity

Dear Karlene:

This is to confirm our commitment to complete the project as outlined in our application for research of transportation capacity of crude oil in North Dakota. We look forward to exploring this very important issue with the Research Council. Thank you for your assistance in completing this application.

Best Wishes,

Robert W. Harms
President
Northern Alliance of Independent Producers

Northern Alliance

of INDEPENDENT PRODUCERS

March 31, 2006

Abstract:

The objective of the Northern Alliance of Independent Producers' (the Alliance) project is to conduct a research project regarding transportation and infrastructure capacity for Williston Basin crude oil, and to identify factors that have influenced or limited the movement of North Dakota product to market, so appropriate responses (regulatory, public policy changes or otherwise) can be implemented. Producers in the Williston Basin have recently experienced severe price differentials, reducing the prices they receive by as much as \$31 per barrel below NYMEX posted price. A host of factors appear to have combined to produce this result, including loss of refining capacity in the Gulf Coast and Denver, increased production in the Williston Basin, soft seasonal markets for refined products in the region, and importation of Canadian crude oil. The result threatens new investment in the State, by producing uncertainty, and will have a significant impact on public and private revenues. A comprehensive study should be conducted to identify exactly what circumstances have caused these differentials to occur.

Project Summary:

The Alliance proposes to retain a national engineering firm that would systematically evaluate:

- the manner in which crude oil products are shipped in the region
- the markets to which ND crude oil is shipped, and influences upon those markets
- the manner in which allocation of capacity is made
- the current capacity to ship product and means of doing so
- the potential for future impacts on existing capacity
- the current response to transportation bottlenecks, the adequacy of those responses and recommendations of additional alternatives to consider.

The engineering firm would do an assessment of all relevant factors and provide a report regarding its findings and its recommendations of possible responses.

Project Description:

North Dakota and the producers operating in the state (and within the Williston Basin) face a serious transportation constraint that has injected a great deal of uncertainty, and threatens the current level of exploration activity now underway. Even though posted prices on the NYMEX exceed \$60 a barrel, producers are routinely being paid \$20-30 less than the posted price because of transportation constraints within the pipeline system that transports most of the production within the basin. As a result, budgets that were previously based on \$40 oil are now in jeopardy because the real price being paid to the producer is closer to \$30. Deep discounts have resulted in approximately 100 wells being shut in, which threatens, correlative rights of the State and private mineral owners, the State's own revenues from royalties and taxes, and jeopardizes the production of the very resource itself. Additionally, the discounts are now causing producers to re-evaluate drilling budgets for the coming year with the possibility of directing those investments to other parts of the country or the world.

These discounts have been the topic of some analysis by both the industry and the state of North Dakota. The Governor and the North Dakota Industrial Commission have been engaged in finding solutions to the extent they can do so. The Department of Mineral Resources is conducting studies to assess the amount of resource (oil and gas) to assist with future investment decisions to expand pipeline capacity. The Department has also been directed by the NDIC to assist in developing solutions to the problem as well.

There is an expectation that the current situation (deep discounts) will resolve in the short term. The Suncor refinery near Denver is expected to be back on line in the near future. The Tesoro refinery in Mandan will be increasing its production for the summer driving season. Additional trucking and rail capacity may also add some additional transportation capacity. Enbridge, a key shipper of North Dakota crude oil is working to expand its capacity in the short term as well. Whether these events happen remains to be seen. But, even if the deep discounts to North Dakota producers dissipate in the short term, they are likely to resume because of continued pressure from Canadian crude oil, seasonal pull backs for refined products, and potentially increased production from the Williston Basin. Producers indicate that this likelihood may very well cripple the current exploration effort if the drivers are not clearly identified and effective solutions implemented in a timely fashion.

As a result, the Alliance believes that it is vital to fully evaluate what is taking place within the crude oil transportation system in North Dakota, and to determine factors of influence, physical capacity, market influences, and possible alternatives to address this situation. The Alliance has been in contact with Pervin & Gertz, Inc., a national engineering firm that specializes in working with clients who are in the production, refining, transportation and marketing of crude oil. Pervin & Gertz has conducted similar studies in the past, particularly with respect to available markets for Canadian heavy and synthetic oil. (See attachments) They indicate a readiness to conduct the above described study regarding the North Dakota market, which would be completed this summer.

Standard of Success:

The success of the proposal will be a comprehensive evaluation of the crude oil transportation system in North Dakota that is completed on a timely basis (by August 31, 2006). This will allow public policy choices, regulatory responses, private investment decisions, and resource allocations that will minimize future impacts of similar forces, and access sufficient transportation capacity to minimize price differentials in the Williston Basin. The ultimate measure of success will be a study report that allows informed decision making to address this problem and ameliorate its effects.

Background:

The Alliance, its members, other producers in the Williston Basin and the North Dakota Land Department itself, have been impacted by the price differentials described above. The delivery system for oil products has a host of constraints and market factors that influence price. The delivery system is in large part a regulated activity. State PUCs regulate much of the siting of pipelines, and “intrastate” transportation of crude oil. FERC regulates the tariffs and “interstate” pipeline transportation of crude oil. Much of the crude oil produced in North Dakota is transported by pipeline to the Tesoro refinery in Mandan, and other markets outside the state. Truck transportation is also a significant part of the transportation system and is less regulated. Trucks transport Canadian crude into North Dakota, while other Williston Basin crude is transported by truck back to Canada. Many of these activities are not well understood. Nonetheless, the negative consequences of the constraints are real and very significant to continued oil activity within the state, along with all of the positive attributes that activity means to North Dakota. The Alliance and its members have been discussing these factors, and believe that a careful examination of the forces that are creating these price differentials is essential for carefully crafted solutions.

Qualifications:

The Alliance is a non-profit trade association representing independent oil and gas producers operating in North Dakota, South Dakota and Montana. Robert W. Harms, its President has been with the organization since its formation, and formerly served as counsel for nearly 11 years to Governor Schafer and Governor Hoeven, serving as an Official Representative for North Dakota to the Interstate Oil and Gas Compact Commission during that time period. Harms also served as senior policy advisor on oil and gas issues during his tenure with the Governor’s Office, and worked closely with the North Dakota Industrial Commission, the North Dakota Petroleum Council and members of the oil and gas industry.

Pervin & Gertz, Inc. is one of the premier engineering firms in the nation, headquartered in Houston Texas, with offices throughout the US and internationally. The firm has conducted a host of studies on the transportation system and markets for US and Canadian crude oil. (See “Firm experience” in attachments.)

Value to North Dakota:

The value of this study to North Dakota will be to:

1. Identify causes and other factors creating price differential for North Dakota crude oil producers.
2. Identify current responses and other potential responses to ameliorate the impact of these price differentials that will result in both short term and long term solutions.
3. Successful response to this situation will preserve the correlative rights of the State of North Dakota and North Dakota mineral owners; will maintain the current level of exploration and development, the economic activity that it produces; will maintain continued development of the resource itself, which is otherwise threatened by jeopardizing wells that are marginally economic because of the price differential and threatened with being shut in, or abandoned. Prematurely abandoning a well because of artificial market forces, in the form of price differentials, may prevent the oil in place from ever being produced because of economic or geologic forces that make the oil no longer recoverable.

Oil revenues make up a significant part of state revenues. ND oil and gas production taxes alone (not including sales and income taxes) represent \$200 million-- 10% of the general fund for the 2005-2007 biennium. (That figure is based upon NYMEX oil prices of less than \$37 per barrel. If oil stays above \$37, revenues will be at least \$40 million higher.)

Management:

The project will be managed by Robert W. Harms, President of the Alliance under direction of the Alliance Board of Directors and members. Harms will solicit and engage the firm of Purvin & Gertz, Inc as described above. In his experience, running his own business for 12 years as a practicing lawyer, and during the 11 years in state government, Harms managed a host of projects including research of complex issues requiring comprehensive solutions that included numerous participants.

Timetable:

Contract signed with engineering firm:	June 1, 2006
Initial draft of report:	July 15, 2006
Final report	August 31, 2006

Project Budget:

Budget:

<u>Expenses:</u>	
Engineering Study	\$16,000
Total	<u>\$16,000</u>
<u>Revenue/Matching funds:</u>	(Cash)
ND Oil and Gas Research Council	\$8,000
NAIP, and industry members	\$8,000
Total	<u>\$16,000</u>

Tax Liability:

I certify that the applicant, the Northern Alliance of Independent Producers has no outstanding tax liability to the State of North Dakota, or its political subdivisions.

March, 31, 2006

Robert W. Harms
President
Northern Alliance of Independent Producers

Confidential Information/Patent Rights to Technical Data:

The Alliance does not make any request that any of the information developed through this program be kept confidential and reserves no rights to patent or technical data developed or acquired through the project.

Potential of U.S./Northern Tier and Canadian Markets to Absorb Heavy and Synthetic Crude

*An objective study to identify the extent of
the markets for Canadian heavy and
synthetic crude, and assess how these
markets can be expanded.*

July 2002



Houston – Los Angeles – London – Calgary – Buenos Aires – Singapore

STUDY DESCRIPTION**POTENTIAL OF U.S. NORTHERN TIER AND CANADIAN MARKETS TO
ABSORB HEAVY AND SYNTHETIC CRUDE****JULY, 2002**

Over the next decade, substantial growth in bitumen production is planned. In the current absence of new refinery developments to process more heavy crude, there are strong concerns that heavy oil supplies will exceed the market capacity, with a resulting impact on heavy oil prices that could jeopardize further heavy oil developments. New synthetic crude projects are also planned, resulting in new supplies entering the market. Thus, there are serious concerns regarding the capabilities of the market to absorb all of the planned production of heavy oil and synthetic crude.

With the solid resource potential in Canada's heavy oil and bitumen deposits, interest appears to be building in the U.S. market to consider more oil from Canada and reduce dependency on Middle East crude supplies. However, heavy oil supply developments are often out of phase with refining developments. This creates peaks and valleys that can be troublesome for both producers and refiners. Producers and refiners are faced with many decisions and uncertainties regarding the development of heavy oil and synthetic crudes. New refining capacity will be needed to process more heavy oil, or more heavy oil needs to be converted into synthetic crude compatible with existing refineries. Either way, more residual processing capacity will be needed. An integrated approach between heavy oil and refining developments may contribute significantly towards bridging the gaps.

PRODUCER ISSUES

- Will the traditional market grow enough to absorb new heavy oil and synthetic crude developments?
- How will world oil prices react to the current economic slowdown catalyzed by the September 11 terrorist attacks on the United States? What is the longer term outlook for world oil prices?
- What price differentials will be needed to ensure that all the heavy oil and synthetic production will be sold?
- Will the pricing outlook be adequate to justify new heavy oil and bitumen developments?
- Are harmonized investments between the upstream and downstream industries necessary to create growth in markets for heavy and synthetic crudes?
- Should producers plan on new upgraders to achieve production growth targets?
- If synthetic crude is used as diluent, will the resulting Synbit blend be widely marketable, and at what price?
- Will synthetic crude supply growth reduce the markets for heavy crude?

- "What is the Alberta advantage?" Due to recent high construction costs in Alberta, where is the best place to add upgrading capacity: upstream or downstream?
- Can synthetic crude replace the rapid decline in Canadian light conventional crude?

REFINER ISSUES

- Will there be adequate Canadian supply developments to allow refiners to increase their capabilities to use more heavy crude?
- Are Canadian heavy crude supply costs low enough for this resource to be a long-term supply source?
- Will the future light/heavy price differential be adequate to foster both heavy supplies and refining developments?
- Will future petroleum product specifications, such as low sulfur gasoline and diesel, and diesel cetane number, affect markets for heavy crude and synthetic crude?
- Will environmental barriers restrict refiners' abilities to use more heavy crude oil?
- Will the traditional markets continue to grow?
- Will refiners switch to new synthetic supplies, and reduce their appetites for heavy crude?

NEW MULTICLIENT STUDY

A new study entitled "**Potential of U.S. Northern Tier and Canadian Markets to Absorb Heavy and Synthetic Crude**" addresses the above issues. It has been designed to focus on the relative dynamics of the upstream and downstream industries that we believe are of utmost importance to both sectors.

The study's objective is to identify the extent of the markets for Canadian heavy and synthetic crude, and assess how these markets can be expanded.

It focuses on the impacts of crude oil prices, heavy oil production plans, refinery plans, and upgrading developments on the upstream/downstream industries so as to provide industry participants with an in-depth appreciation of the issues and explore relevant solutions to these issues.

This study builds on a recent multiclient study "**Diluent Outlook and Alternatives for Heavy Oil**", completed in September 2001. It also incorporates Purvin & Gertz' "**Global Petroleum Market Outlook**" ongoing service to provide crude oil supply/demand balances by region and pricing.

HEAVY AND SYNTHETIC CRUDE SUPPLY

The potential supply from the immense Canadian bitumen and heavy resource base is limited by markets and adequate netback prices. The shift from declining conventional production to bitumen and synthetic supplies is addressed in the outlook for future Canadian

production. A base case and a potential supply scenario are analyzed. The demand and availability of diluent to assist heavy oil transportation is summarized, and the availability of alternative blends such as bitumen/synthetic crude is forecast.

In the U.S. market, the supply of conventional crude by region and by type is analyzed and forecast. Potential supplies from offshore Gulf of Mexico are included in the domestic supply framework of this study.

The analysis examines supplies of heavy and synthetic crude from Venezuela, Mexico, and other Latin American countries. The potential of future heavy supply developments from these countries is forecast based on current developments. The probable disposition of output from current and future upgrading projects in the Orinoco belt is addressed.

The cost of supply of heavy oil and synthetic crude for Canada and Latin America is provided.

HEAVY OIL UPGRADING, REFINING AND TRANSPORTATION

This section analyzes upgrading in Alberta and at downstream refineries. We look at the addition of new processing capacity in Alberta to upgrade heavy crude and bitumen to synthetic crude. We also address the major issues for market expansion via upgrading.

Capital costs for new construction projects have risen recently in Alberta. We review this issue, and outline the sensitivity of the economics of Alberta projects to capital costs.

The addition or expansion of residual upgrading capacity in existing refineries is evaluated. Existing catalytic cracking and residual processing capacity in these markets is examined, based on refinery simulations as well as input from our refiner survey, with emphasis given to expanding these capabilities. The market potential and value of synthetic crude/bitumen (Synbit) blends is determined, and compared to the conventional condensate/heavy crude blends.

The economics of upgrading in the field or in refineries are compared. We also compare the economics of integrating upgrading additions between producer sites and refinery sites. Transportation costs and the impacts of choice of diluent are addressed, including the use of synthetic crude as a substantial diluent in the future.

HEAVY AND SYNTHETIC CRUDE MARKETS

Unlike previous periods of wide light/heavy differentials, the wide differentials in late 2000/early 2001 have not appeared to attract new interest by U.S. or Canadian refiners in more Canadian heavy crude. Refining capacity limits are being approached, while refiners are focused primarily on adding desulfurization capacity to reduce sulfur in gasoline and diesel fuel to meet future environmental specifications.

What will be the impact of Venezuela and Mexico's heavy oil production plans on the U.S. market? This market will continue to increase its reliance on imported supplies. Between

2000 and 2002, around 280,000 B/D of residual processing capacity will be added to the U.S. Gulf Coast market. Most of these projects were initiated so that more Mexican and Venezuelan heavy crude would have a home in the U.S. market. Now, there do not appear to be many new major residual conversion projects in the planning stages in U.S. refineries, yet Latin America and Canada are planning to bring on more heavy crude production.

Potential new markets for bitumen blends and synthetic crude were studied, based on our refinery assessments and discussions with refiners. Bitumen blends cover both Cold Lake and Athabasca bitumen, and condensate and synthetic crude diluents. The analysis covers the demand for heavy blends in Canadian and U.S. markets, including the ability of refiners to convert heavy crude into light products and the demand for asphalt. Vacuum gas oil (VGO) utilization and disposition were analyzed. Existing catalytic cracking and residual processing capacity in these markets were examined regarding defining the limits for markets for heavy and synthetic crude supplies. The potential for market expansion through the addition of new refining capacity was developed based on the results of the upgrading analysis.

A thorough analysis of the PADD II, PADD IV, and PADD V markets was made to provide an assessment of the future growth prospects for refiners in these regions. A complete demand outlook for petroleum products was prepared for each of these regions. The ability to compete with expansions in product pipelines from the U.S. Gulf Coast refiners is crucial to the industry in these regions. Most importantly, the growing surplus of crude from the deepwater Gulf of Mexico will compete with Canadian supplies in the Midwest market.

An assessment of crude oil balances by crude type was prepared for the traditional Canadian heavy oil and synthetic crude markets in PADD I, II, IV and PADD V. The impact of increased market penetration for synthetic and heavy crudes on regional crude balances was evaluated.

SYNTHETIC CRUDE OIL MARKET DEVELOPMENT

Synthetic crude markets have developed to accommodate increases in production from the Athabasca oilsands projects and the Saskatchewan upgrading projects. Experience has shown that as supply increases, prices experience a market penetration discount. As new supplies come on stream, more markets will need to be developed and retained. We examined the potential to place more synthetic crude in existing markets, and outlined potential increases in markets through refinery modifications. Utilization of the extra vacuum gas oil and diesel yields was evaluated. The impact of quality matters such as diesel cetane is addressed.

The economics of retrofitting existing refineries to process more synthetic crude was studied. Every refinery in PADD II, PADD IV, and Northern PADD V was modeled to best identify the likely candidates to take more synthetic crude, and outline the changes and the associated costs. From this assessment, a buildup of increased market potential versus netback prices was prepared.

PRICING AND ECONOMIC COMPARISON

A complete forecast of crude oil prices and refined products prices is provided consistent with overall residual conversion requirements to determine a long-term outlook for light/heavy price differentials. Netback prices for synthetic crude and heavy oil are provided consistent with the market and pricing outlook.

A comparison of the merits of upgrading in the field versus development of new markets in refineries is included. It addresses the economics of marketing a heavy blend versus synthetic crude. A risk assessment of the key variables is incorporated into the economic assessment.

COST TO SUBSCRIBERS

The cost for subscribers is \$19,000 (US).

For companies wishing to subscribe to the recent analysis on diluent; "**Diluent Outlook and Alternatives for Heavy Oil**", we are prepared to offer a package price for both studies. Subscribers of the diluent study will be entitled to receive this new study at a special price.

PURVIN & GERTZ EXPERIENCE

Purvin & Gertz has actively assisted many clients over the past several years in Canadian heavy crude market analyses, refining capabilities to process more heavy crude, strategic options for heavy crude producers, economics of upgrading, Venezuelan Orinoco projects, and crude transportation analyses. Purvin & Gertz, through its worldwide consulting activities, keeps abreast of market trends, refinery technology, and new project developments. We maintain a number of economic tools and refinery models, including the PIMS linear programming tool. Although Purvin & Gertz continues to build its depth of experience through these ongoing analyses, the looming potential supplies of bitumen and synthetic crude warrant this new, detailed study. It will be of value to producers, refiners, crude oil transporters, and policy makers.

A brief summary of recent experience follows:

- A recent study "**Diluent Outlook and Alternatives for Heavy Oil**" was prepared in September 2001. In this study, Purvin & Gertz analyzed the available supplies of diluent for heavy crude blending, marketability and value of blends. The study provided a bitumen production forecast and developed upgrading costs and economics. The analysis highlighted the use of synthetic crude as a long-term diluent alternative. This study will be an important building block for the proposed study.
- In early 2001, Purvin & Gertz addressed the impact of low sulfur gasoline on all Canadian refineries, including the impact on Canadian markets. Every refiner in Canada participated in this assessment.

- Purvin & Gertz has undertaken several major market analyses recently for heavy crude and bitumen; and for a variety of synthetic crude oils. Many issues regarding quality, marketability, and pricing were addressed.
- In 2000, Purvin & Gertz modelled most of the refineries in Canada and in the U.S. Northern Tier regarding their ability to process more synthetic crude. The potential to increase synthetic crude consumption was assessed.
- In 1998, Purvin & Gertz completed a multiclient study entitled "**Canadian Heavy Crude Oil Markets: Adapting to New Challenges**". This study provided a complete assessment of Canadian heavy crude supply, demand for heavy crude, pricing, and logistical issues.
- Purvin & Gertz prepared a comparison of standalone upgrading, partial upgrading with refinery modifications, and modifying refineries to expand markets for Canadian bitumen. This study was performed in 1997 for an industry group.
- On a monthly basis Purvin & Gertz provides clients with a variety of services including market assessments and short term forecasts for crude oil, refined products, natural gas and NGL's. These include supply, demand and pricing in North America, including Western Canada. Examples of monthly reports include:
 - **Crude Oil & Refining Outlook: Canadian/U.S. Midwest Edition**
 - **Oil & Gas Outlook: Canadian Edition**
 - **NGL Market Outlook: North American Edition**
- Purvin & Gertz provides its "**Global Petroleum Market Outlook**" to regular subscribers on an ongoing basis. This provides our long range forecast of prices, margins and light/heavy differentials in different markets, as well as regional crude and product balances. It is updated at regular intervals.

AVAILABILITY AND TERMS

The cost for this study is \$19,000 (U.S.). To subscribe, please sign a copy of the attached subscription form and return to Purvin & Gertz. This form includes the terms and conditions for the subscription.

Two (2) copies of the report will be furnished, along with one copy on CD ROM. Additional report copies will be made available at \$150 (US) per copy.

A presentation can be arranged in Calgary or the client's office, at a mutually agreeable time, based on Purvin & Gertz' fees and expenses.

The report is for the exclusive use of the purchasing company and its subsidiaries (100% of ownership), or for the purchasing company and its parent company if the parent company owns 100% of the purchasing company.

This report has been prepared for the sole benefit of the client. Neither the report or any part of the report shall be provided to third parties without the written consent of Purvin & Gertz, Inc. Any third party in possession of this report may not rely upon its conclusions without written

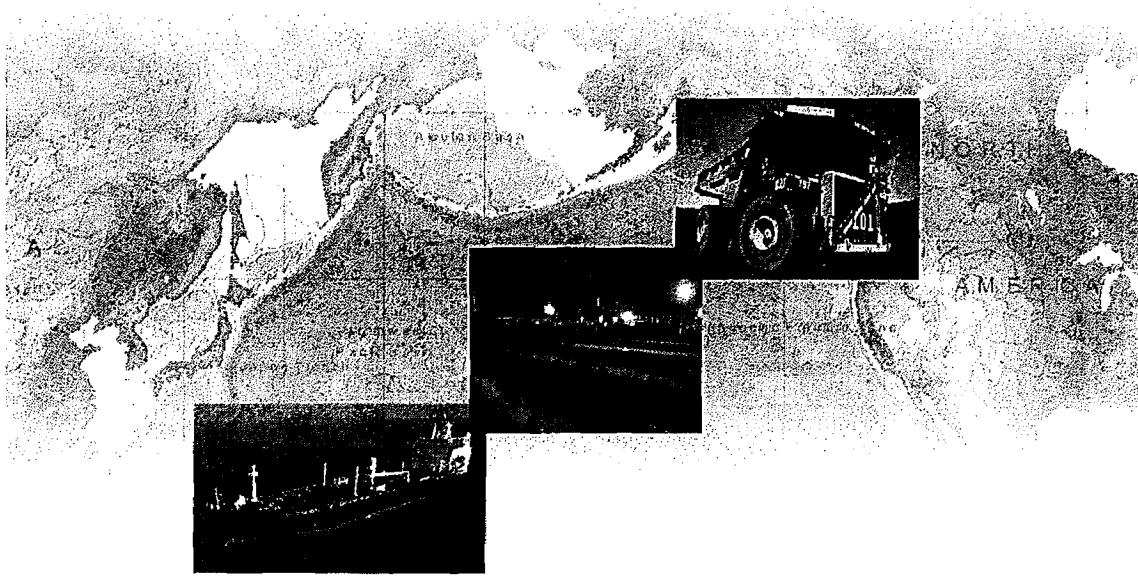
consent from Purvin & Gertz. Possession of the report does not carry with it the right of publication.

Purvin & Gertz conducted this analysis and prepared this report utilizing reasonable care and skill in applying methods of analysis consistent with normal industry practice. All results are based on information available at the time of review. Changes in factors upon which the review is based could affect the results. Forecasts are inherently uncertain because of events or combinations of events that cannot reasonably be foreseen including the actions of government, individuals, third parties and competitors. **There is no implied warranty of merchantability or fitness for a particular purpose.**

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Global Markets for Canadian Oil Sands Crudes



PURVIN
& GERTZ
INC.

Study Description

International Energy Consultants

Buenos Aires Calgary Houston London Long Beach Moscow Singapore

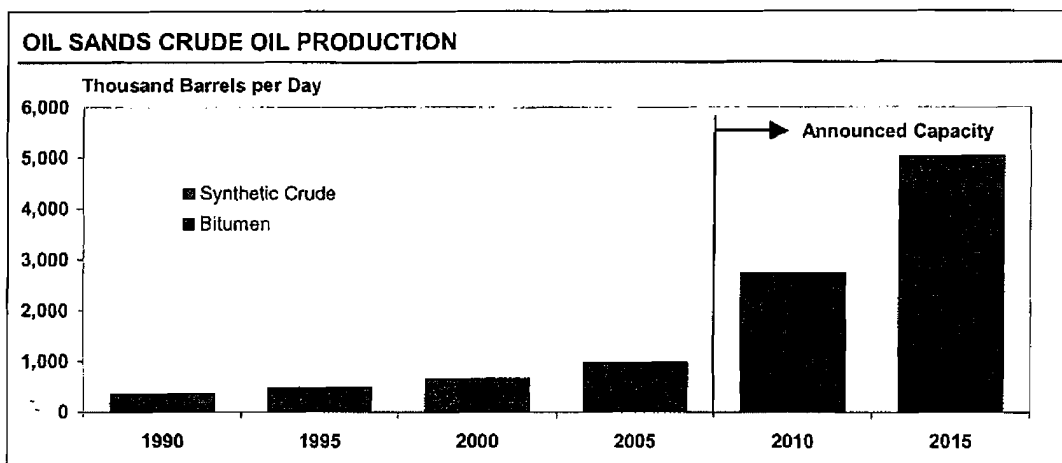
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Cover images courtesy of Syncrude Canada Ltd. and Enbridge Inc.

STUDY BACKGROUND

High crude oil prices are stimulating investments in oil sands development. Over the next decade, substantial growth in bitumen production is planned. As illustrated below, the potential for bitumen and upgraded synthetic crude oil production is in excess of 6 million B/D, based on announced projects. Due to limitations on project resources in Alberta, the actual production trend is likely to grow at a slower pace.



Although new refinery conversion capacity to process more heavy crude is planned, there are concerns that heavy oil supplies will exceed the current market capacity, with a resulting impact on heavy oil prices that could jeopardize further heavy oil developments. New upgrading projects to produce synthetic crude oil (SCO) are also planned, resulting in new supplies entering the market. Thus, there are serious concerns regarding the capabilities of the market to absorb all of the planned production of heavy oil and synthetic crude oil as well as questions related to diluent supply for pipeline movement.

With the solid resource potential in Canada's oil sands deposits, interest is growing in the U.S. market to consider more oil from Canada. Heavy oil supply developments are often out-of-phase with refining developments, and this creates economic cycles that can be troublesome for both producers and refiners. Producers and refiners are faced with many decisions and uncertainties regarding the development of bitumen and synthetic crudes. New refining capacity will be needed to process more heavy oil, or more heavy oil needs to be converted into synthetic crudes which are compatible with existing refineries. Either way, more residual processing capacity will be needed. Access to new refining markets may also be needed. An integrated approach between heavy oil and refining developments may contribute significantly towards bridging supply/demand gaps.

KEY ISSUES

Study subscribers will receive information essential to their strategic planning efforts. It is clear that a period of major change in Western Canadian oil sands development lies ahead. The response to the following issues will be critical to the success of producers, refiners and other industry participants over the next 15 years. The study will allow subscribers to plan future investments with confidence, based on sound fundamental analysis by Purvin & Gertz.

PRODUCER ISSUES

- Will the traditional market grow enough to absorb new heavy oil and synthetic crude oil developments?
- Will market diversification to the Gulf Coast, West Coast and Northeast Asia increase netback prices?
- Will the rapid growth in crude oil demand in Northeast Asia provide market opportunities for Canadian bitumen blends and/or synthetic crude oils?
- Would production of new grades of synthetic crude oil expand the market potential and would the pricing support the upgrader investments?
- What pipeline changes and diluent sources are needed for Canada to supply the expanding and/or new markets?
- Will refiners switch to new synthetic crude oils, and reduce their appetites for heavy crude?
- How will world oil prices affect demand for heavy oil and synthetic crude oils? What is the longer term outlook for world oil prices?
- What price differentials will be needed to ensure that all the heavy oil and SCO production will be sold and to justify upgrading?
- Will the pricing outlook for crude and diluent provide adequate netbacks to support new oil sands developments?
- Are harmonized investments between the upstream and downstream industries necessary to create growth in markets for heavy and synthetic crudes?
- Should producers plan on new upgraders in Alberta to achieve production growth?
- "What is the Alberta advantage?" Due to recent high construction costs in Alberta, where is the best place to add upgrading capacity: upstream or downstream?

REFINER ISSUES

- Will there be adequate Canadian supply developments to allow refiners to increase their capabilities to use more heavy blend or synthetic crude oil? Will new markets reduce the supplies available to the traditional markets?
- Are Canadian oil sands supply costs low enough to be a long term supply source?
- Will the future light/heavy price differential be adequate to foster both heavy supplies and refining developments?
- Will future petroleum product specifications, such as low sulfur gasoline and diesel and diesel cetane, affect markets for heavy blends and synthetic crude oils?
- Will environmental barriers restrict refiners' abilities to use more heavy crude oil?
- How can large quantities of heavy oil or synthetic crude oil best be used by refineries?
- Will the crudes from oil sands have suitable qualities and be competitive with other crude supplies?
- What qualities of heavy blends or synthetic crude oil would be most desirable if oil sands producers could provide these?
- What refinery changes are needed to increase throughput of oil sands feedstocks and will pricing support the investments?

STUDY DESCRIPTION

A new study, entitled **Global Markets for Canadian Oil Sands Crudes**, addresses the above issues. It focuses on the relative dynamics of the upstream and downstream industries that we believe are of utmost importance to both sectors.

The study's objective is to identify the extent of the markets for various blends of Canadian heavy crude and a variety of synthetic crude oils, and assess how these markets can be expanded. Included is an assessment of new pipeline systems required to expand markets and potential new supplies of diluent.

The study focuses on the impacts of crude oil prices, heavy oil production plans, refinery plans, and upgrading developments on the upstream/downstream industries, in order to provide study subscribers with an in-depth appreciation of the issues and to explore relevant solutions to these issues.

This study takes advantage of Purvin & Gertz' global resources, as well as its significant experience in the Alberta market. It utilizes the Purvin & Gertz **Global Petroleum Market Outlook** subscription service to provide crude oil supply/demand balances and pricing by region. It builds on previous multiclient studies undertaken in the Calgary office, including **Potential of U.S. Northern Tier and Canadian Markets to Absorb Heavy and Synthetic Crude**, which was completed in July 2002. A detailed outline of the report is found on page 9.

HEAVY AND SYNTHETIC CRUDE OIL SUPPLY

The potential supply from the immense Canadian bitumen resource base is limited by several factors, including project resources, markets and adequate netback prices. The shift from declining conventional production to bitumen and synthetic crude oil supplies is addressed in the outlook for future Canadian production. The costs of supply of bitumen and synthetic crude oil production are presented, based on a survey of producers and our own analysis.

Bitumen requires diluent to produce blends that can be shipped by pipeline. The diluent requirements for different bitumen blends are forecast, including regional analysis by oil sands area. Diluent supplies and economics have been analyzed as discussed below.

The growth in Canadian crude supply will exceed domestic requirements, leading to an increasing surplus for export. The report provides detailed balances for Canadian crude oil by region and type.

The analysis of crude oil supply includes the base case scenario, as well as two alternative scenarios. Marketed crude oil supplies will depend on field production, but also on the type and availability of diluent, and the market strategy pursued by Alberta-based producers.

HEAVY OIL UPGRADING AND REFINING

Upgrading of bitumen is a necessary step in the value chain to convert the raw material into refined products. In the report we present our analysis of upgrading in Alberta and at downstream refineries. We will look at the addition of new processing capacity in Alberta to upgrade bitumen to various synthetic crude oils.

Synthetic crude oils may include light sweet grades, medium grades (that resemble conventional medium sour crudes), partially upgraded heavy sour grades (that are suitable for pipeline transportation), and synthetic diluent. The market potential for each type of synthetic crude oil has been assessed.

Capital costs for new construction projects are increasing in Alberta. We have reviewed this issue, and outline in the report the sensitivity of project economics of Alberta projects to capital costs.

The addition or expansion of residual upgrading capacity in existing refineries has been evaluated. Refinery changes and their associated costs are presented. For this analysis, Purvin & Gertz relied on its proprietary refinery LP models to analyze refinery capabilities in the key market regions. The full range of crude oils, from synthetic crude oil/bitumen (SynBit) blends, to conventional condensate/heavy crude blends (DilBit), to partially or fully upgraded SCO, is evaluated. The processing of additional vacuum gas oil and/or residual product in existing refineries will be a key driver for growth in heavy and synthetic crude oil markets. For this assessment, Purvin & Gertz has relied on its proven methodologies and refinery models to analyze refining capabilities and future requirements in the key market regions.

The economics of upgrading in the field versus in refineries are compared. We also compare the economics of integrating upgrading additions between production sites and refinery sites. A full sensitivity analysis is included for each upgrading case, to assess the impact of key variables on project profitability.

MARKETS FOR BITUMEN BLENDS

More refining capacity will be needed to meet demand growth while accommodating a shift in crude oil availability and quality. Current pricing for light and heavy crude oil provides a strong incentive for refiners to upgrade their facilities. Potential new markets for bitumen blends are quantified, based on our refinery assessments and discussions with refiners. Bitumen blends of Cold Lake and Athabasca bitumen with condensate and synthetic crude oil diluents are analyzed. The analysis covers the demand for heavy blends in traditional Canadian and U.S. markets. In addition, potential markets such as the U.S. West Coast and in Northeast Asia are investigated.

We have assessed the ability of refiners to convert heavy crude into light products as well as the demand for asphalt. Vacuum gas oil (VGO) and residue availability and disposition have been analyzed. Existing catalytic cracking and residual processing capacity in these

markets is examined regarding the limits for markets for heavy and synthetic crude oil supplies. The potential for market expansion through the addition of new refining capacity is based on the results of the upgrading analysis.

U.S. PADD II, PADD IV, and PADD V markets are analyzed to provide an assessment of the future growth prospects for refiners in these regions. For PADD V (West Coast), domestic supplies and competitive imports are considered. Canadian crude exports to PADD III (Gulf Coast) are projected, consistent with pipeline developments.

For Northeast Asia, we have assessed the ability of existing refineries to readily use heavy crude blends with or without modifications. Since refining capacity is growing rapidly in China, we have considered grassroots refining of heavy crude in that market.

MARKETS FOR SYNTHETIC CRUDE OIL

Markets for synthetic crude oils are being developed to accommodate increases in production from the Alberta oil sands projects. As supply increases, prices experience a market penetration discount. As new supplies come on stream, more markets will need to be developed and retained. In the report, we examine the potential to place more synthetic crude oil in existing markets through crude substitution, and outline potential increases in markets through refinery modifications. Utilization of the extra vacuum gas oil and diesel yields are evaluated. The impact of quality matters such as diesel cetane and FCC feed are also addressed.

The economics of retrofitting existing refineries to process more synthetic crude oil have been studied. Specific refinery types for regions in PADD II, PADD IV, and Northern PADD V were modeled so as to best identify the likely candidates to take more synthetic crude oil. We analyzed the Northeast Asia markets to estimate potential demand for synthetic crude oil of varying quality.

In addition to sweet, bottomless synthetic crude, we have studied the markets for medium sour and heavy sour synthetic crude oil. Similar conventional crudes are used in PADD II, PADD V and Asia, but Canadian oil sands have not yet competed in this sector.

REGIONAL CRUDE OIL MARKETS

To analyze the potential demand for heavy blends and synthetic crudes, we provide an outlook through 2020 for crude oil balances in Canada, the U.S. (by PADD) and Northeast Asia (China, Japan and South Korea). We reviewed existing refining capacity and have provided crude balances by crude type (light sweet, light sour and heavy) with import projections.

A quantitative analysis of the market potential for oil sands crudes is presented for the U.S. Northern Tier. The crude balances take into account regional product requirements, and include announced refinery capacity additions for each region. An analysis of 2015 capacity

requirements for PADD II, PADD IV and PADD V is presented, based on the forecast processing of conventional and oil sands crudes.

The analysis of Northeast Asian markets for oil sands crudes is based upon country-specific product trade balances. The outlook for refinery capacity additions is presented. A detailed qualitative analysis of oil sands crude market potential is provided, based on a comparison of crude import requirements and the characteristics of individual oil sands crudes.

PRICING AND ECONOMIC COMPARISON

A forecast of crude oil prices is provided, consistent with overall residual conversion requirements to determine a long term outlook for light/heavy price differentials. Netback prices for a variety of synthetic crude oils and heavy oils has been prepared consistent with the market and pricing outlook and transportation costs. Bitumen netbacks are shown for various diluents. We have compared netback prices for individual oil sands crudes from the Midwest, West Coast and Northeast Asia.

TRANSPORTATION

As oil sands production increases, more pipeline capacity and more diluent will be needed. Pipelines will be needed within Alberta (from the resource sites to transportation hubs) as well as outside Alberta to reach ultimate markets. Based on production forecasts, we estimate the timing and magnitude of regional pipeline additions and discuss the numerous proposals that have been announced for new pipeline projects. We determine netback prices from different markets based on transportation costs via the various proposed routes.

Diluent is a major issue affecting heavy crude supply. Condensate supply in Western Canada from natural gas production is near its peak, while diluent demand is increasing along with bitumen production. Condensate is in short supply and this has resulted in a significant price premium. Synthetic crude oil has been used for SynBit in recent years but markets and pricing are causing industry players to seek alternative diluent solutions. Some potential sources of condensate include imports and diluent recycle but economical transportation systems would be needed. We have assessed the potential for condensate imports and the impact of imports on the crude balance. Alternative diluents may impact bitumen netback prices, and this has been evaluated in the study.

Other alternatives to address the diluent issue include upgrading bitumen to a synthetic diluent, or upgrading more bitumen to avoid diluent altogether. These options are discussed in the next section "Heavy Oil Upgrading and Refining."

AVAILABILITY AND TERMS

Global Markets for Canadian Oil Sands Crudes is available immediately to clients on a subscription basis. The terms and prices are detailed in the Subscription Agreement. For details contact either Steven Kelly (Senior Vice President and Study Director) at sjkelly@purvingertz.com or Tom Wise (Vice President) at thwise@purvingertz.com.

Subscribers to Purvin & Gertz' full Global Petroleum Market Outlook (GPMO) receive a discount on the subscription to the **Global Markets for Canadian Oil Sands Crudes** study. The GPMO is available to new subscribers and is described under Purvin & Gertz Experience.

A printed copy of the report will be provided together with one copy on CD. Additional copies of the report may be purchased for a nominal charge. The report tables are provided in Excel format, for convenient access and transfer into clients' own models.

A detailed report outline is given on the following page. An Executive Summary is available in Section II, to provide the essential results of the analysis in a convenient form.

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PURVIN & GERTZ EXPERIENCE

Purvin & Gertz, Inc. is an independent energy consulting firm which provides advice and assistance related to the energy and chemical industries to private companies, financial institutions, and government organizations in all parts of the world. We specialize in serving companies in such fields as natural gas, natural gas liquids, gas processing and refining, transportation and marketing of crude oil, petroleum products, petrochemicals and electricity.

Purvin & Gertz' staff is comprised primarily of chemical engineers, and some MBAs and economists with extensive industrial and commercial experience, including marketing and economic analysis. We understand the interrelationships between the technical, commercial, strategic, regulatory, and economic aspects of the energy and chemical industries. To serve our domestic and international clients, we maintain offices in Houston, Calgary, Los Angeles, London, Moscow, Singapore, and Buenos Aires.

Purvin & Gertz has served a broad spectrum of clients for over 58 years. Most client relationships have involved a number of individual projects over the years. We have worked extensively in the energy and petrochemical industries, and have analyzed many facets of the businesses, including:

- Strategic plan development and implementation
- Market analysis including regional and worldwide supply, demand and pricing analysis and outlook
- Sales/supply contract analysis, purchase strategy
- Marketing strategies
- Project feasibility analysis, business valuation and asset appraisals
- Assistance in mergers, acquisitions and privatization
- Assessment of impact of regulatory changes
- Expert witness and dispute resolution
- Scenario analysis
- Technical and operational reviews

Additional information regarding Purvin & Gertz can be obtained from our website at www.purvingertz.com.

RELEVANT EXPERIENCE REGARDING OIL SANDS MARKETS

Purvin & Gertz has been actively involved in the analysis of markets for Canadian crude oil since our firm was founded in 1947. Purvin & Gertz opened its Calgary office in 1973 and has provided commercial and technical consulting advice on commercial oil sands upgrading projects and markets since then.

Over the past several years, Purvin & Gertz has provided both Canadian and international clients extensive consulting assistance in the analysis of Canadian heavy crude markets, refining capabilities to process more heavy crude, strategic options for heavy crude producers, economics of upgrading, and crude transportation analyses. Purvin & Gertz has also provided a wealth of consulting assistance to participants and financial institutions related to the markets for all of the Orinoco upgrading projects. We stay abreast of market trends, refinery technology, and new project developments through our worldwide consulting activities. We maintain a number of economic tools and refinery models, including the PIMS linear programming tool. Although Purvin & Gertz continues to build its depth of experience through these ongoing analyses, the enormous potential of the Canadian oil sands, and the keen interest being demonstrated by a growing number of global companies confirms that the timing is right for this new study by Purvin & Gertz.

A brief summary of recent experience follows:

- In 2005, Purvin & Gertz has analyzed markets and prices for selected oil sands products in Asia-Pacific. The netbacks considered the prices of competitive crudes, refining values, marine and pipeline costs.
- In 2004, Purvin & Gertz carried out two phases of a study to investigate the production of refined products and petrochemicals by upgrading bitumen for the Alberta government and industry participants. This study involved pricing of bitumen, synthetic crude and products. The costs and economics of Alberta upgrading were compared with those for upgrading existing refineries in the U.S.
- In 2004, Purvin & Gertz carried out a multiclient study, **Fuel Options for Oil Sands Development**, to compare the technologies and capital and operating costs for using alternative fuels for producing steam, power and hydrogen for the Alberta oil sands. Direct burning with emission controls was considered along with gasification. Alternative fuels included natural gas, heavy oil, coal and coke.
- In 2003, Purvin & Gertz carried out a study of the California refining market and its potential demand for a light synthetic sour crude. The refining values and netback prices were forecast.
- In 2003, Purvin & Gertz was retained to estimate the market value of de-asphalted bitumen. This was compared with bitumen values for de-asphalter economics.

- In 2002, Purvin & Gertz completed a major multiclient study, **Potential of U.S. Northern Tier and Canadian Markets to Absorb Heavy and Synthetic Crude**. This analysis included a detailed analysis of Canadian and U.S. crude oil and petroleum products markets. Detailed modeling of most refineries that have access to Canadian crude oil was undertaken, and refineries located in California were also modeled assuming they were able to receive Canadian crudes.
- In September 2001, a multiclient study, **Diluent Outlook and Alternatives for Heavy Oil**, was prepared. Purvin & Gertz analyzed the available supplies of diluent for heavy crude blending, marketability and value of blends. The study provided a bitumen production forecast and developed upgrading costs and economics. The analysis highlighted the use of synthetic crude as a long term diluent alternative. This study will be an important building block for the proposed study.
- On a monthly basis Purvin & Gertz provides clients with a variety of services including market assessments and short term forecasts for crude oil, refined products, natural gas and NGLs. These include supply, demand and pricing in North America, including Western Canada. Examples of monthly reports include:
 - Crude Oil & Refining Outlook: Canadian/U.S. Midwest Edition
 - Oil & Gas Outlook: Canadian Edition
 - NGL Market Outlook: North American Edition
 - Purvin & Gertz provides its **Global Petroleum Market Outlook** to regular subscribers on an ongoing basis. This provides our long range forecast of prices, margins and light/ heavy differentials in different markets, as well as regional crude and product balances.

RELEVANT EXPERIENCE IN INTERNATIONAL PETROLEUM MARKETS

Key aspects of the analysis of potential markets for Canadian crude oil will involve knowledge of the Asia markets for crude oil as well as the U.S. West Coast market. Purvin & Gertz is well qualified to analyze these markets through our full-time consulting presence in and knowledge of these international markets.

- Purvin & Gertz has maintained an active consulting presence in Asia through our Singapore office since it opened in 1992. A major aspect of our consulting activities in Asia is the analysis of refined product and crude oil markets in the region. We routinely assist regional refiners, resource producers, transportation companies and financial institutions in the analysis of crude oil and condensate markets and pricing.
- Purvin & Gertz has maintained a full time presence on the U.S. West Coast since 1982 through our Long Beach office. Our consulting activities on the West Coast provide an unequaled knowledge of the local refined product and crude oil markets and logistics as well as the regional refining industry.

Founded in 1947, Purvin & Gertz is an independent consulting firm providing technical, commercial and strategic advice concerning the oil, gas, chemical, and power generation industries.

Purvin & Gertz specializes in serving clients involved in the production, processing, transportation and marketing of crude oil, petroleum products, natural gas and LPG.

The firm consists primarily of chemical engineers with extensive experience in analyzing the technical, commercial, and economic inter-relationships in the industries we serve.

With an international network of offices in North America, Europe, Russia, Latin America and Asia, the team at Purvin & Gertz offers a complete understanding of the energy and petroleum markets.

Purvin & Gertz is an employee-owned firm, operating independently of any holding company, engineering/construction firm or process licensor. Our objective expertise has proven its worth in the success of many of the world's leading companies.

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