ATTACHMENT A

EXPERT REBUTTAL REPORT OF RANDY MEYER (APR. 8, 2022)

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WISCONSIN

BAD RIVER BAND OF THE LAKE SUPERIOR TRIBE OF CHIPPEWA INDIANS OF THE BAD RIVER RESERVATION *Plaintiff,* v. ENBRIDGE ENERGY COMPANY, INC., and ENBRIDGE ENERGY, L.P. *Defendants*	Case No. 3:19-cv-00602-wmc Judge William M. Conley Magistrate Judge Stephen L. Crocker
ENBRIDGE ENERGY COMPANY, INC., and ENBRIDGE ENERGY, L.P. *Counter-Plaintiff,* v. BAD RIVER BAND OF THE LAKE SUPERIOR TRIBE OF CHIPPEWA INDIANS OF THE BAD RIVER RESERVATION and NAOMI TILLISON, in her official capacity *Counter-Defendants*	

EXPERT REBUTTAL REPORT OF

RANDY MEYER

April 8, 2022

Note: Portions of this report may contain information designated as confidential by Enbridge pursuant to the stipulated protective order in *Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation v. Enbridge Energy Company, Inc.*, Case No. 3:19-cv-00602-wmc (Dkts. 49, 50).

1. My name is Randy Meyer. I am the founder and Principal Consultant at Third Rail Group, Inc., which I established in 2017. Third Rail provides consulting services in four main areas primarily related to transportation: Innovation & Technology, Business Development, Sales and Marketing, and Logistics and Transportation Operations. This includes consulting services in rail transportation, terminal networks, commercial negotiations, business development, and logistics information systems.
2. I am also Vice President of Transportation for Nauticol Energy, where I am responsible for all transportation, logistics, and carrier and terminal long-term contract negotiations to support the building of a $3.5 billion methanol facility. I have held this position since November 2018. In this position, I have lead rail contract and marine terminal development contract negotiations, as well as located and designed an 800-plus unit train rail terminal.
3. Prior to this position, from 2012 to 2017, I was Vice President of Corporate Development and Logistics for Altex Energy, Ltd. In that position, I was responsible for commercial negotiations; rail carrier interface; the development of all facilities, processes, information systems for the corporation and service delivery for Altex customers; overseeing sales and marketing; and the development of new crude oil rail loading and unloading terminals in Canada and the United States and the logistics systems and technology to manage them. In that time, I built six crude oil loading rail terminals, coordinated successful public engagement for terminal permitting, negotiated long-term shipper and rail carrier contracts, and co-invented CDN patent 2829003 (Process and Facility for Fluid Transfer Between Tanker Trucks and Railroad Tank Cars).
4. Prior to that, I spent 35 years with Canadian National Railway (CN). For my last few years

at CN, I served as Senior Manager of Business Development (2011-2012) and Director of Sales (2010-2011). From 1978 to 2010, I served in a variety of business development, sales, and marketing roles (1996-2010), information system roles (1985-1996), and railway operations roles (1978-1985). While at CN, I developed CN's PipelineOnRail (crude-by-rail) initiative and headed up CN's long-term business development strategy, primarily relating to the petroleum industry in Western Canada. I also developed the Lashburn, Saskatchewan crude-by-rail terminal and led a large engineering study to build bridges, rail connections, and pipelines to oil sands projects. A copy of my portfolio containing more information regarding my various projects at CN and in my other positions is available at Exhibit 1.

5. I have authored one article for a third-party publication in the last ten years: "The Case for Rail to Transport Oil," TORONTO SUN (May 13, 2016).

6. Within the previous four years, I have not served as an expert witness at trial or by deposition.

7. I am being compensated at $225 per hour for my work on this matter. My compensation in no way depends on the outcome of this case.

8. The Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation (the "Band" or "Plaintiff") has filed a suit seeking a declaratory judgment that Enbridge's continued use of Line 5 across the Bad River Reservation constitutes a public nuisance and a trespass, and an order of ejectment and an injunction requiring Enbridge to cease the operation of Line 5 on the Reservation and to remove it safely from the

Reservation.[1]

9. I have been asked by the Band to review the expert report submitted by William J. Rennicke from Oliver Wyman Inc. on January 31, 2022, and to provide any rebuttal opinion with respect to Mr. Rennicke's analysis of the availability and feasibility of alternative transportation options to the movement of crude oil and natural gas liquids on Line 5.

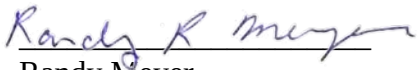
10. A complete statement of the opinions that I will express in this matter and the basis and reasons for them can be found in Exhibit 2. I have been supported in my work on this matter by one of Third Rail's consultants.

11. The exhibits I will use to summarize or support them can also be found in Exhibit 2.

12. A list of materials that I have considered in forming the opinions for this report can be found in Exhibit 2 (Appendix A-Works Cited).

[1] Third Amended Complaint at 60, *Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation v. Enbridge Energy Company, Inc.*, Case No. 3:19-cv-00602-wmc (W.D. Wisc.).

I declare under penalty of perjury that the foregoing is true and correct.



Randy Meyer

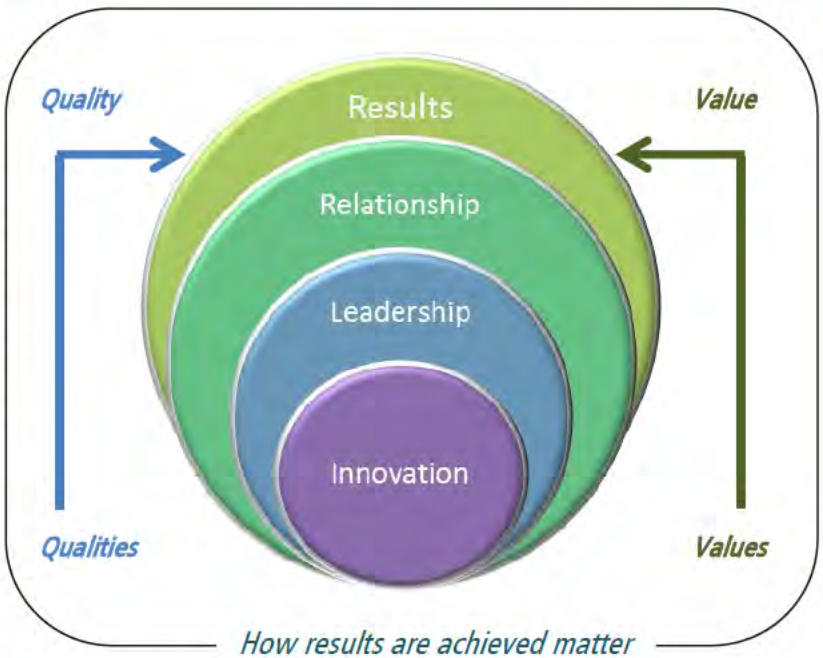
April 8, 2022

EXHIBIT 1

Randy R. Meyer

162 Woodpark Circle SW
Calgary, AB T2W 6G1
587-215-2900 randy.meyer@shaw.ca

Portfolio



Results Matter – Executive Summary

Business Development

Sectors: Co-founded Crude-By-Rail (CBR)
Hydro-carbons, Sulphur, Metals
Fertilizers, Lumber, more…
Altex Energy: Co-creator CBR business
CN Rail: Created PipelineOnRail business
Multi-commodity transload model
Infrastructure: Unit train rail terminals
Distribution facilities

Sales & Marketing

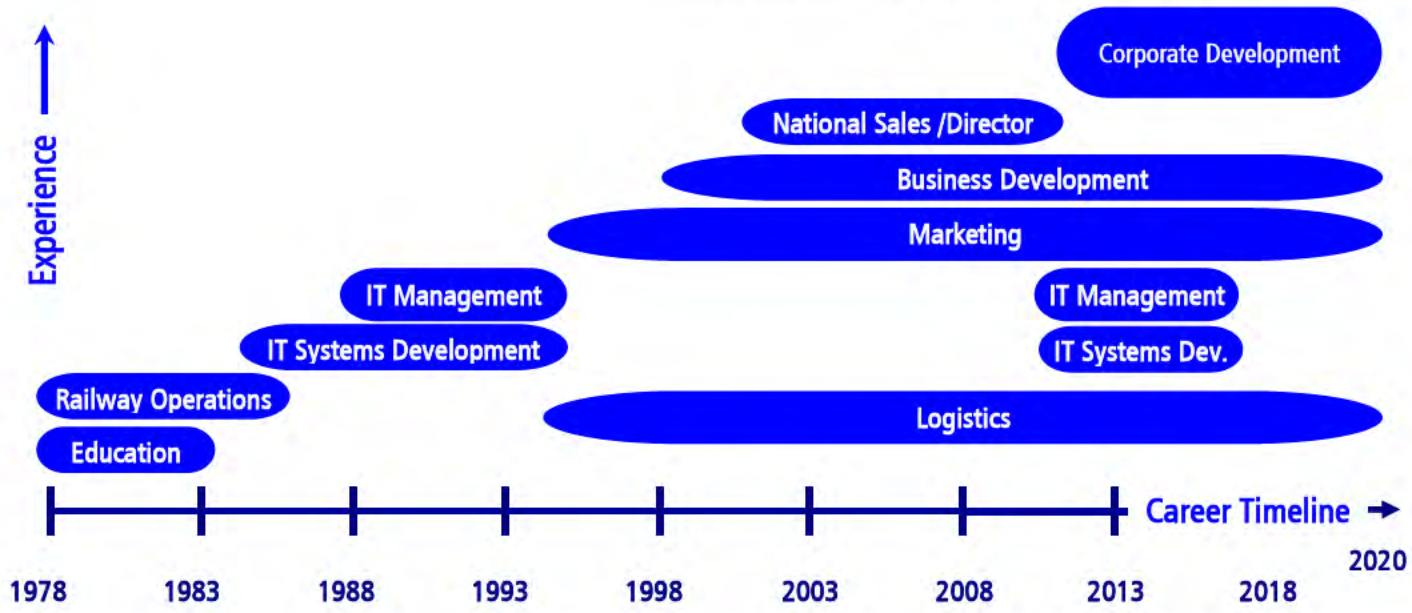
Sales: Team management
$390M yearly budget
Long term contracts
Relationship management
Marketing: Sector analyses
New products/services
Price setting
Budgets

Innovation & Technology

IT: Programmer, System developer
Project management
Logistics systems, EDI, Embedded systems, SCADA
SRED: iGoRail Logistics expert system
Scientific Research credits
Patents: Rail, Truck, Tank terminal process CDN 02829003

Luck is where opportunity meets preparation.

– Seneca, Roman dramatist, philosopher, & politician (5 BC - 65 AD)



Personal Summary - Biography

Randy is currently the Principal Consultant at Third Rail Group, Inc. Third Rail Group provides consulting services in four main areas related primarily to transportation: Innovation & Technology, Business Development, Sales and Marketing and Logistics and Transportation Operations. He is responsible for providing consulting services in rail transportation, terminal networks, commercial negotiations, business development and logistics information systems.

Randy is also the VP of Transportation for Nauticol Energy having begun work as a consultant for Nauticol in November 2018. He is responsible for all the transportation, logistics and carrier and terminal long-term contract negotiations to support the building of a $2.5B methanol facility.

Randy previously served as Vice President Corporate Development and Logistics for Altex Energy Ltd for 5 years. He was responsible for: commercial negotiations, rail carrier interface, the development of all facilities, processes, information systems for the corporation and service delivery for Altex customers, overseeing sales and marketing, the development of new crude oil rail loading and unloading terminals in Canada and the US and the logistics systems and technology to manage them.

Prior to this, Randy spent 35 years with CN (Canadian National Railway), most recently serving as Senior Manager of Business Development. Randy developed CN's PipelineOnRail (crude-by-rail) initiative and headed up CN's long-term business development strategy primarily relating to the petroleum industry in Western Canada. The PipelineOnRail project became a significant business representing hundreds of millions of dollars per year in new business to CN.

He started his career in CN Operations in Toronto and moved to CN headquarters in Montreal, where he spent 12 years holding increasingly responsible positions in Project Management and Systems Development in CN's Information Systems and Marketing Systems departments.

From there, he moved to Calgary spent 17 years in increasingly responsible positions in Service Management, Market Management, Account Management and Director of Sales in various business sectors including petroleum and chemicals, coal, fertilizers, metals, sulphur and other industrial products.

Major Accomplishments

- Lead Altex Energy's corporate development; building executive and senior management teams and process systems to run the business
- Negotiated long-term contracts with North American rail carriers
- Developed logistics expert and enterprise management computer system called iGoRail
- Received significant Scientific Research and Experimental Development (SRED) funds for iGoRail
- Developed new logistics, inventory management and electronic rail car inspection systems
- Development and permitting of major rail terminals including tank farms and truck unloading
- Successful management of municipal and provincial government relations
- Co-inventor of process patent for rail, truck and tank terminals loading and unloading heavy crudes
- Developed CN's Crude-by-Rail, oil sands business and multi-commodity transload business
- Developed major multi-commodity transload facilities in Calgary and Fort McMurray for CN
- Lead teams of business development, sales, marketing and information systems professionals
- Grew revenues through long-term (4 to 20 year) contracts
- Managed large sales budgets in excess of $390M for CN
- Recognized by Oilsands Review magazine as one of the "5 Faces of the Oilsands" in 2014
- Represented CN in many industry and government conferences including at the Canadian Embassy in Tokyo

Executive and Senior Management Positions, 2010 - 2020

Nauticol Energy – November 2018 - Present
Calgary, AB
Vice President Transportation

Accomplishments

Key member of project team developing a $2.5B methanol plant
Lead rail contract negotiations saving $100's of millions
Lead marine terminal development contract negotiations saving $100's of millions
Assisted in international marketing contracts development
Located and designed 800+ unit train rail terminal

Prince Rupert, BC Marine Terminal

Third Rail Group – July 2017 - Present
Calgary, AB
Principal Consultant

Accomplishments

Established new consulting company in Business Development, Sales, Marketing, Logistics, Operations and Innovation and Technology across a wide variety of commodities and business sectors (www.thirdrailgroup.ca)
Developed transportation logistics, fleet planning and economics models for input into NI 43-101 reserves of a frac sand mine
Provided transportation consulting services for various project feasibility studies


Many Transportation Sectors, Commercial & Technology

Altex Energy – December 2012 - March 2017
Calgary, AB
Vice President – Corporate Development & Logistics

Accomplishments

Lead the Business Development, Sales, Marketing, Logistics and Information Systems groups
Built executive and senior management leadership teams
Built 6 crude oil loading rail terminals
Successful public engagement for terminal permitting
Municipal, Provincial and Federal government engagement
Negotiated long-term shipper and rail carrier contracts
Built expert logistics/enterprise management computer system
Built revolutionary electronic railcar inspection systems
Developed Altex' website and most content
Authored several videos including aerial drone videos
Co-inventor CDN patent 2829003


Lashburn, SK Unit Train Terminal

Professional Chronology – 40 Years of Leadership

Canadian National Railway – June 1978 - December 2012
Toronto, ON, Montreal, QC, Calgary, AB

Senior Manager Business Development
Calgary, AB April 2011 – December 2012

Accomplishments

Engagement with CEO, CFO, CMO, VPs and other senior leadership to develop large scale projects
Lead large engineering study to build bridges, rail connections and pipelines to oil sands projects
Redesigned and redeveloped Ft. McMurray, AB (Lynton) railyard
Developed Lashburn, SK crude-by-rail terminal
Added $15M/yr in new revenue with growth potential to $60M/yr


Lynton, AB Multi-Commodity Transload

Director of Sales
Calgary, AB February 2010 – April 2011

Accomplishments

Lead a team of senior sales professionals with a budget of $390M
Developed sales management processes and negotiating strategies
Exceeded sales targets by growing new business offerings
Shipped first crude oil on CN creating a business worth $100'sM


Lloydminster, AB First Crude Oil Shipment

Business Development, Sales and Marketing Positions, 1996 - 2010

Manager Oil Sands Sales
Calgary, AB 2007 – 2010

Accomplishments

Developed corporate oil sands development and sales strategy
Concluded a very long-term contract for sulphur exports
Developed communications plan
Represented CN as a speaker at many industry conferences
Developed CN's PipelineOnRail project (crude-by-rail)


Prince Rupert, BC Sulphur

Account Manager – Industrial Products (Sulphur)
Calgary, AB 2003 – 2007

Accomplishments

Reversed 10 years of rate erosion signing a long-term contract
Grew revenue from $~71M to ~$116M over 4 years
Developed a project to form sulphur at Prince Rupert, BC
Developed a new way to ship solid sulphur in containers to Asia

Account Manager – Divisional Sales
Calgary, AB 2000 – 2003

Accomplishments

Grew revenues from $6M - $17M
Developed CN's first multi-commodity transload facility
Developed new steel I-Beam loading plan for centre beam railcars
Acquired many new customers rejuvenating rail industry in Calgary

Market Manager – Fertilizer
Calgary, AB 1999– 2000
Market Analyst – Fertilizer
Calgary, AB 1997– 1999

Accomplishments

Developed comprehensive market database
Analyze market trends and develop long-term market strategies
Set pricing and budgets
Developed negotiating strategies
Developed a computerized rate making tool

Service Officer – Coal, Sulphur, Fertilizer
Calgary, AB 1996-1997

Accomplishments

Developed new product and services offerings
Developed electronic scale out facility at customer plant
Developed logistics support
Work on a quality action team recreating the supply and distribution processes for a major customer.

Professional Chronology – 40 Years of Quality

Information Systems 1985 - 1996

Project Development Asst, EDI Consultant, Marketing
Montreal, QC 1994-1996

Accomplishments

Developed just in time inventory and pipeline management system
Developed and implement electronic commerce (EDI) interfaces with customers' systems

Senior Programmer Analyst – Information Systems
Montreal, QC 1987 – 1991

Accomplishments

Developed and coded crew management and other systems on both mainframe and PC hardware. (COBOL, C, BASIC, Assembler)
Approved code and system design

Programmer – Information Systems
Montreal, QC 1985– 1985

Accomplishments

Designed and coded application programs for the Transportation Manpower Operating System (TMOS) project using C, Basic and some Assembler.

Project Analyst, Information Systems
Montreal, QC 1991-1994

Accomplishments

Supervised a team of 6 IT professionals
Directed and approved all systems design, development, code, support and maintenance for entire projects

Asst. Programmer Analyst – Information Systems
Montreal, QC 1985– 1987

Accomplishments

Developed vacation scheduling system
Coded programs on PC and mainframes using COBOL, C, Basic and assembler.

Rantech Electronics 1983 – 1984
Toronto, ON
Purchasing Agent – Electronic Components
Designed and developed a computer system and programs to calculate electronic component requirements for production jobs and projects.
Established an inventory management system

Railway Operations 1978 - 1985

Special Duties, Office of the Superintendent
MacMillan Yard, Toronto, ON 1984-1985

Accomplishments

Completed yard traffic analysis and optimization study
Develop computerized radio inventory control system

Various Clerical, Operations
MacMillan Yard, Toronto, ON 1978-1984

Accomplishments

Worked the spareboard while also attending school. Jobs included Car Checker, Train Clerk, Waybill Clerk, General Yard Master's Clerk, Foreman's Clerk, Fuel Truck Driver, and Labourer in diesel shop.
As a result of the various hands on job experiences, I learned a lot about train and yard operations. You could consider this part of a "railroad MBA program". This training served me well throughout my career in the rail industry.

Professional Development

Professional Training

Computer Science, Marketing (BSc. Incomplete) University of Athabasca, Athabasca, AB	1999-2008
Technical School Certificate, Sales (CSP) Canadian Professional Sales Association, Calgary, AB	2002-2002
College Incomplete, Computer Science DeVry Institute of Technology, Toronto, ON	1983-1985
College Incomplete, Computer Science Seneca College, Toronto, ON	1979-1982

Desktop Software, Programming Languages

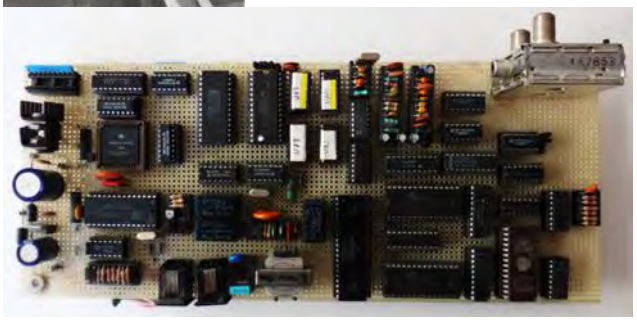
Expert: MS EXCEL, WORD and Power Point, C, BASIC, Visual Basic, SQL
Advanced: Correl Visual Studio (Video maker), COBOL, Assembler
Novice: JOOMLA, Java, HTML, PHP, SCADA

Hobbies, Interests and Other Accomplishments

1978 – Guinness Book of Records for building the world`s largest slide rule
Qualified competitive swimming judge

Self-taught in electronics and have designed and built computers and specialized circuits from the circuit board up.

This board had a telephone, television and modem designed to interface with remote computers and local television and telephone sets.



Programmed embedded real-time systems in C and assembler.

References, Endorsements and External Links

See LinkedIn page for Randy Meyer for several endorsements for various skills from various professionals.
See Third Rail Group webpage for further expertise information. www.thirdrailgroup.ca
References available upon request

Selected Magazine and other publication articles

https://www.albertaoilmagazine.com/2016/08/shipping-neatbit-rail-answer-looking-arent-looking/
https://www.crude-marketing.com/p5383/understanding-how-crude-shippers-can-optimally-use-current-rail-routes/
http://www.torontosun.com/2016/05/13/the-case-for-rail-to-transport-oil
http://www.jwnenergy.com/article/2015/2/grizzly-oil-sands-finds-sweet-spot-incorporation-crude-rail/

EXHIBIT 2

Third Rail Group

Response to William Rennicke Report
Possibility of Shipping Enbridge Line 5 Commodities by Rail

CONFIDENTIAL

Table of Contents

List of Figures and Tables

1 Introduction

Third Rail Group is a private consulting firm providing expertise through the entire transportation supply chain from conception to ongoing management. We were one of the pioneers of the crude-by-rail industry, multi-modal distribution facilities and complex expert systems to manage these enterprises.
Our consulting experts and affiliates have decades of industry experience in building, permitting, and operating rail terminals and other facilities, which allows us to achieve real world results.

I am the Principal Consultant and owner of Third Rail Group. I have been in the rail transportation and logistics business for over 43 years. I spent 35 years with Canadian National Railway (CN) and held subsequent executive positions with Altex Energy and Nauticol Energy.

From CN Operations in Toronto, I moved to CN headquarters in Montreal where I spent 12 years in CN's information and Marketing System departments. I led a team of programmers designing and coding sophisticated transportation related computer systems.

Moving to Calgary for CN, I spent 17 years in increasingly responsible positions in Service Management, Market Management, Senior Account Management and Director of Sales in various business sectors including petroleum and chemicals, coal, fertilizers, metals, sulphur, and other industrial products. During this time, I negotiated dozens of rail transportation contracts and developed thousands of rail rates.

As Senior Manager of Business Development, I developed CN's PipelineOnRail (crude-by-rail) initiative and headed up CN's long-term business development strategy primarily relating to the petroleum industry in Western Canada. In late 2007 early 2008, I wrote the original white paper for CN on the competitiveness of rail versus pipeline for moving heavy crude oil. This paper convinced the Chief Marketing Officer, CEO, and other senior executives that rail was a viable competitive option to pipelines.

This launched the first rail industry foray into competing with crude oil pipelines in over 100 years. Along with executives at Altex Energy, I spent the next 2 years educating the marketplace and other rail carriers on the economics and capabilities of crude-by-rail. In 2010, CN moved is first crude-by-rail shipment.

As this was an important project for CN, I was seconded by Altex Energy in 2012 as the VP Corporate Development & Logistics. I had responsibility for sales and marketing, the development of new crude oil rail terminals in Canada and the US, and the logistics systems and technology to manage them. I am the co-inventor of the Canadian patent CA 2829003 for truck to rail (and vice versa) terminals loading for crude oil.

I developed the expert computer systems to manage these terminals and received Scientific Research and Experimental Development (SRED) grants and tax rebates based on it being a new novel system and approach.

I wrote the economics of crude by-rail that many in the industry still use as the basis, at least in part, for crude-by-rail projects including the new diluent recovery unit at Hardisty, AB.

In 2015 I retired from CN and in 2017 I left Alex Energy to start Third Rail Group. I have been retained to work as a subject matter expert (SME) for various projects, negotiate large rail contracts, develop new rail terminals, provide logistics modeling and other transportation and logistics services.

In 2018, I was retained by Nauticol Energy to help with the development of a $3.5 billion, 3.4 million MT methanol production facility. Subsequentially in 2019, I was retained under an employment contract as the Vice President of Transportation for Nauticol. I negotiated the long-term rail contract, developed the rail terminal location and logistics model, and negotiated the marine terminal contracts for the methanol facility.

Table 1 – Selected Projects Randy Meyer

Terminal Development			
Location	Year	Auspices	Description
Grande Prairie, AB	2018-Current	Nauticol Energy	Developing a 3.4M MT per year 800 car, unit train terminal.
Greater Toronto (ON) Area	2021-2022	Third Rail Group	A 600M (159M US gal) to1B litre (264M US gal) per year gasoline, ethanol supply and blend terminal. Developed business case, the engineering and construction RFPs. Negotiated long-term rail freight and railcar supply contracts. Currently under construction.
Lashburn, SK Unity, SK Falher, AB Wainwright, AB Reno, AB	2012-2014	Altex Energy	Permitted and constructed crude-by-rail terminals. Ranging from small car blocks to 100+ car unit trains.
Fort McMurray, AB	2011-2012	CN Rail	Developed a major redesign of the Ft. McMurray, AB rail yard (Lynton). Wrote the business case. Project management of the reconstruction.
Lloydminster, SK	2010	CN Rail	Developed first crude-by-rail terminal on CN.
Calgary, AB	2002	CN Rail	Developed the first multi-commodity transload truck to rail and rail to truck.

Terminal Development			
Location	Year	Auspices	Description
Rail Freight Contract Negotiations			
Company	Year	Perspective	Commodities, Value, Description
Nauticol Energy	2019-2022	Shipper	Methanol, over $950M CDN, unit train long-term contract
Confidential Client	2021	Shipper, Consultant	Fertilizer products, ~$135M US contract renegotiation.
Altex Energy	2013-2017	Shipper	Crude oil, condensate, over $100M, unit-train and manifest, long-term, over $985M US
Various shippers too numerous to list. Example: Husky, Suncor, Shell, Glencore, PBF Energy	2007-2011	Railway	Petroleum (LPG, crude oil, refined products, etc.) and chemicals, machinery, metals, and various other commodities, $390M CDN portfolio, varying term contracts and tariffs.
Sultran and other sulphur producers	2003-2007	Railway	Formed and liquid sulphur, ~$116M, unit train and manifest service, short to mid-term contracts and tariffs
Rail Logistics & Economics Studies			
Company	Year	Type	Description
Confidential fertilizer company	2020	Subject matter expert	Review economics, logistics and operating plan for a new $1B+ mine.
City of Sioux Lookout, ON	2019	Feasibility	Determine the economics and feasibility of a rail terminal to serve mining sector.
Confidential mineral company	2017	Terminal Development	Part of a National Instruments NI 43-101 study for proven and probable reserves of a new mine.

2 Engagement

Third Rail Group has been retained by the Bad River Band of the Lake Superior Tribe of Chippewa Indians (the "Band") to provide its expert opinion on the report submitted by William Rennicke of Oliver Wyman ("Rennicke Report"). The Rennicke Report addresses the feasibility of using other modes of transport (truck, rail, other pipelines) as a replacement means of transport for crude oil and natural gas liquids (NGLs) presently shipped over Enbridge's Line 5 pipeline in the event that the line is shut down.

Line 5 runs through the Band's reservation in northern Wisconsin. Our understanding is that the Band served notice in 2017 that it would not renew the lease for the pipeline to traverse the Band's land. The Band and Enbridge are engaged in litigation over this matter.

Upon reading the Protective Order from the Court, signing and delivering the Acknowledgement of the Order to counsel for the Band, Third Rail Group performed an initial review of the Rennicke Report. It became clear very quickly based on our experience and knowledge that significant errors and faulty assumptions were made in the Rennicke Report. However, we avoided forming any final conclusions until we had completed the research and investigations described in this report.

3 Disclaimer and Disclosure

Third Rail Group has produced this report in good faith and has used reasonable industry practices to arrive at the conclusions contained in this report. These conclusions are subject to our current understanding of the issues at this time. We reserve the right to amend our conclusions if new information becomes available that would warrant our changing them.

3.1 Completeness and Accuracy

This information contained in this report comes from publicly available data, our work and experience in the industry and from certain projects we have been or are involved in. We have also been provided confidential reports and other information by counsel for the Band for our examination.

We have no reason to believe that any of the publicly available data is incorrect, incomplete, or faulty. We believe that the publicly available information used generally fits our understanding of the subject matter.

We may have relied on certain data provided in confidential reports or other information. To the extent we have used any of that information, we have no reason to believe that it is incorrect, incomplete, or faulty – the exception being where we are making the assertion that certain information that others may have relied upon is incorrect, incomplete, or faulty.

Given the large volumes of information available concerning this subject, it is not possible to have considered every possible source. However, we believe that we have reviewed information substantial enough to reasonably form the conclusions contained in this report.

Nevertheless, should any of information used prove incorrect or a new source of information become available, we reserve the right to amend our conclusions.

3.2 No Endorsement

Third Rail Group takes no position on the merits of the legal action between the Band and Enbridge. That is strictly a matter between those parties.

Third Rail Group takes no position on the merits of the continued operation of Enbridge's Line 5. Whether the pipeline continues in operation or not is of no interest to Third Rail Group.

3.3 Disclosures

Randy Meyer is a small shareholder in Canadian National Railway (a publicly traded railway company) and Altex Energy (a privately held crude-by-rail company). Neither of these facts influenced any of the findings in this report. Nor is there any substantial gain to be had based on any outcome of this report.

Third Rail Group has received remuneration for this report at $225 US per hour. This has not in any way influenced the conclusions of this report.

4 Summary of Opinions

Based upon my 43 years of experience in the rail transportation and logistics business, particularly my experience using rail to compete with pipelines, and independent analysis and review of relevant materials, particularly but not limited to the William Rennicke of Oliver Wyman Report ("Rennicke Report"), I have reached the following conclusions, which are then detailed in subsequent sections of this report.

4.1 Conclusion One: The Rennicke Report Rests on Faulty and Unjustified Assumptions

The Rennicke Report is built upon faulty assumptions that start at the beginning of the report and are carried through to its final conclusions. These assumptions lead to some rather irrelevant or inaccurate analysis of, among other things, the capacity of railways, the ability of the market to respond, the nature of markets themselves and the economics of the entire logistics supply chain.

4.1.1 There Has Been Time to Prepare Alternatives to Line 5

The overall premise of the Rennicke Report from which many of the conclusions are drawn is that the markets have not had time to, and would not be able to, adjust to the winddown of Line 5.

"I have concluded that shutting down Line 5 for any period of time would have substantial adverse impacts on the transportation and delivery of essential petroleum products in the affected region and elsewhere." (1 p. 2)

While an abrupt shutdown could present supply chain problems in the short term, in reality, Enbridge and shippers have been on notice that Line 5 may shut down for several years.

My understanding is that in 2017 the Band passed a formal Resolution informing Enbridge that it would not renew the lease allowing the pipeline to traverse its land.

Since 2019, moreover, the State of Michigan has been raising the issue of Enbridge's compliance with the terms of the pipeline easement through the Straits of Mackinac, ultimately resulting in the State's revocation of the easement in November of 2020.

Therefore, there has been a substantial amount of time for shippers to make alternative arrangements for supply and transportation since notifications were sent to Enbridge in 2017 and then in 2020.

Enbridge and some of its shippers may have chosen to rely on a strategy of rerouting the pipeline which is risky and will take an indeterminate amount of time and is by no means guaranteed. This is their choice, but it cannot then be argued that there was no time in the past years for an orderly winddown and/or for shippers to prepare contingency plans.

As I describe in the sections that follow, there are multiple ways in which the market could react to replace supply in the face of Line 5 shutdown, and a number of such steps are already being taken.

4.1.2 Rennicke Report: Rail Is Not a Viable Option

The Rennicke Report concludes that rail is not a viable option for transporting the crude oil or natural gas liquids (NGL's) presently conveyed by Line 5 based largely on the following faulty premises:

1) Rail does not have capacity to move the volume of crude oil (226.7k bpd) and NGLS (83.9k bpd) that can not be diverted to other pipelines (1 p. 10)
   a) The assumption that the Edmonton to Sarnia rail corridor is at 100% capacity
   b) The premise that, even if rail lines had the capacity, the rail tank car fleet is at 100% capacity and new cars would have to be built
   c) The premise that rail does not have the loading or unloading capacity

2) The only rail market source considered for any of the commodities moving on Line 5 is from essentially the same market sources as Line 5 which is the Edmonton, Alberta area

3) There could be no orderly start up of a rail system
   a) It would take years to permit rail facilities
   b) It is "... impossible to obtain the required environmental permits." (1 p. 19) for rail loading and unloading terminals
   c) Even if rail could start up, it would only be short-term and therefore not economically viable

4) Railways would face opposition to increased movements in Edmonton – Sarnia corridor (1 p. 5)

4.1.2.1 Rail Does Have the Capacity

Rail does have the capacity to move the 226.7k bp of crude oil that the Rennicke Report states would have to be replaced in the event of a Line 5 shutdown – and more. Crude oil transport by rail (not including undiluted heavy oil) peaked at 412k bpd in February 2020 and dropped to as low as 39k bpd in July of 2020 (2). As of December 2021, crude oil by rail shipments are back to 131k bpd but are not expected to recover to their previous highs (3). These shipments were primarily to the United States although some small amounts would have been to eastern Canada.

That's a swing of 373k bpd from high to low leaving a current additional capacity of at least 281k bpd from the peak rail capacity. Rail volumes for many commodities like crude-oil, grain, fertilizers, etc. are highly cyclical. Railways have capacity to accommodate these fluctuations.

This crude oil moves largely in the same corridor as the Edmonton to Sarnia corridor at least as far as Chicago. So, the corridor capacity and the rail cars to move the Line 5 crude oil volumes exist today.

Rail loading capacity in Canada alone is 1,331,000 barrels per day (bpd) (4). This capacity far exceeds the capacity that would be required if Line 5 were to shut down. When the North Dakota Williston Basin rail loading capacity is added (see Table 2), rail capacity is at least 2,561,000 bpd. This is about 4.7 times the total capacity of Line 5.

4.1.2.2 Rail Can Source from a Much Greater Market Than Line 5

There is no reason why crude oil or propane/butane must only be sourced from the greater Edmonton area or just Alberta for that matter. They are many other sources like North Dakota (Bakken), the US NE (Marcellus) or the US Gulf Coast (Mont Belvieu, TX and Conway, KS) for example. Rail has access to the entire North American Market and many import locations.

Not only would rail provide additional sources of products, but it would also use alternate transportation corridors to the Edmonton-Sarnia corridor.

4.1.2.3 Rail Facilities Could Continue to Operate

The Rennicke Report assumes that once rail facilities are established, they would not continue to operate once Enbridge's Line 5 rerouting project is completed. Therefore, for example, parties would not acquire rail car fleet when lessors want long-term leases (~7 years) and the rail cars would only be used in the short-term.

There is no evidence for this assumption. Once rail cars have been acquired and other facilities are built, it would be prudent to keep using these facilities since they would provide optionality and security of supply. We see this in the marketplace today with the dozens of crude-by-rail facilities that ship crude to refineries that are already served by pipeline.

4.1.2.4 Rail Facilities Are Not Difficult to Permit

Rail facilities such as load and unloading terminals are not difficult to permit and certainly not impossible as the Rennicke Report claims (1 p. 19). In Canada, Class I railways are regulated federally and are given significant powers to develop rail infrastructure particularly when they are located near or on railway land. American railways have similar powers.

Generally, building terminals on rail ways lands in Canada does not even need a municipal building permit. For example, I was involved in building rail terminals in Fort McMurray, Alberta, Lloydminster, Saskatchewan, Unity, Saskatchewan and in the Greater Toronto area without any municipal building permits because they were built on railway land.

The terminals do need to meet prescriptive regulations such as national fire codes, local fire codes required by the local fire marshal, provincial road regulations for acceleration and deceleration

lanes, storm water management and so on. Any required permits are generally easily acquired after the submission of applications showing appropriate engineering and design.

In Canada, no federal environmental impact assessment (EIA) is required for rail yards under 50 hectares (~124 acres). The unit train a day crude-by-rail terminal at Lashburn, SK is about 25 hectares.

There were dozens of rail terminals built in Canada and the United States in the early years of crude by rail starting in 2010. Altex Energy itself built 6 terminals from late 2010 to 2014. Many more terminals have been built and expanded over the years with an estimated 1,331,000 bpd loading capacity in Canada alone (4).

North Dakota grew from essentially zero capacity pre 2010 to 95,000bpd in 2010, 245,000bpd in 2011 and 740,000bpd in 2012 (5). This is incredibly fast growth.

Table 2 – US Williston Basin Rail Loading Capacity[1]

US Williston Basin - Year End Rail Loading Capacity													
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ND	95,000	245,000	740,000	1,150,000	1,240,000	1,240,000	1,330,000	1,185,000	1,185,000	1,185,000	1,115,000	1,050,000	1,050,000
MT					20,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Total	95,000	245,000	740,000	1,150,000	1,260,000	1,420,000	1,510,000	1,365,000	1,365,000	1,365,000	1,295,000	1,230,000	1,230,000

Contrary to the Rennicke Report, the explosive growth in both Canada and the United States in crude-by-rail capacity shows that is relatively easy to permit facilities and relatively quick to build them. They are certainly not impossible to permit (1 p. 19).

4.1.3 Rennicke Report: Rail Can Not Economically Compete with Pipeline

The Rennicke Report provides a limited calculation of the comparison of rail and pipeline transportation costs (1 p. 69). These calculations do not represent the entire supply chain or opportunity costs.

There are several factors as follows that were not considered in the Rennicke Report, a number of which are focused on in this report:

1) Total delivered costs
   a) Differences in fractionation costs
   b) Differences in storage costs
   c) Differences in rail costs from different markets
   d) Time to market costs

[1] Derived from Oil Transportation Table, North Dakota Pipeline Authority (5)

e) Economies of scale
f) The "diluent penalty"
g) Batching/interface/segregation costs
h) Processing costs to meet pipeline specifications
i) Apportionment
j) Loss allowances

2) Diverse market access benefits
   a) Arbitrage opportunities
   b) Optimization of feedstocks
   c) Optimization of condensate supply
   d) Security of supply

3) Oil Types
   a) Heavy oil versus lighter oils
   b) Decline rates of well production

4.1.3.1 Rail Does Economically Compete with Pipeline

It is clear that rail does compete when these and other factors are considered. We know this from the market investing hundreds of millions of dollars in capital into dozens of crude-by-rail facilities in both Canada and the United States.

As shown in 4.1.2.1, these facilities in Canada have grown from essentially zero capacity pre-2010 to at least 2,561,000 bpd today. If these facilities were not economic and served no market purpose, no one would have had the economic justification to build them.

We also know that in 2012-2013 Kinder Morgan Cochin ULC made application to reverse its Cochin pipeline. Instead of delivering pure propane and butane into Sarnia, the company wanted to reverse the pipeline to deliver condensate from the United States to the Edmonton area. According to National Energy Board filings in Canada made by the company, it claimed that the reason for the reversal in part was because there were "... more cost-effective options for transporting their product, including both rail and pipeline." (6 p. 5) The application was granted.

According to the Canadian Energy Regulator, 76% of all propane exports from Canada were by rail compared to 7% by pipeline. Even the fractionators who are supplied with the NGL mix from Line 5 rely on rail and truck for delivery of the propane and butane they produce.

According to the US Energy Information Administration (EIA), just over three years after a starting point of 0% in late 2011, 52% of the crude oil supply to East Coast refineries (PADD1) was supplied by rail by February 2015 (7).

Contrary to the Rennicke Report, rail clearly competes with pipelines in these markets.

4.1.4 Rail Safety and Environment Issues

The Rennicke Report raises the issue of rail safety and spills (1 pp. 7,20). The general thrust is that more trains will potentially cause more crossing accidents and potentially more spills into the environment.

4.1.4.1 Differences in Rail and Pipeline Safety Records are Inconsequential

But this does not square with reports from Oliver Wyman (Mr. Rennicke's consultancy) in 2015 (8) and 2019 (9) comparing the safety of rail and pipelines for transporting crude oil. Both reports arrive at the same summary conclusion.

From the 2019 Oliver Wyman report:

"*In summary, analysis of the available data shows that differences between the modes are inconsequential. The data shows that though differences between the modes vary by metric and from year to year, those differences are small. Both modes have excellent safety records and are continuing to work to improve safety. Most critically, both pipelines and railways are needed to handle Canada's production of crude oil and related products – especially as Canadian crude oil production continues to grow in the future."* (9 p. 13)

I fully agree with the summary conclusion of these reports.

4.1.4.2 Rail Crossings are Safe

The Rennicke Report's assertion that rail may be unsafe is again contradicted by Oliver Wyman's own report: "Both modes have excellent safety records." (9 p. 13) Referring back to my conclusions of railway capacity, the amount of volume in the corridor for just crude oil alone has diminished from 412k bpd to as low as 39K bpd. As these volumes from Canada have ramped up and down since about 2010, the Rennicke Report provides no data on the impacts on rail crossing accidents.

The only data the Rennicke Report provides is the number of road-rail crossings between Edmonton and Sarnia and the average number of cars crossing them daily. (1 p. 62) The assertion is that as train traffic and/or road traffic increases, "… the number of accidents can increase." (1 p. 61)

But the Rennicke Report contradicts itself by saying that due to hundreds of millions of dollars being invested in improving the safety of at-grade crossings, there "… has been a steady lowering of the rate of fatalities associated with at-grade crossings." (1 p. 61)

Because the Rennicke Report provides no associated accident rates year over year or at all, the reader of that report may well conclude that with more train traffic and road traffic there will be more accidents. However, the data does not show such a correlation.

The following tables illustrate that there has instead been a downward trend in road-rail crossings and that because the incident rate is so low, fluctuations of rail and/or road traffic do not produce any significant difference in the number of actual accidents.

Table 3 shows the absolute crossing incidents in the corridor from Alberta to the United States border. This data includes all crossing incidents in a Province not just solely along the route of potential shipments from the greater Edmonton area. This means there is an upward bias in the absolute incidents considered.

Table 3 – Main Track Crossing Accidents AB-ON[2]

Crossing Accidents on Main Track											
Province	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AB	36	37	47	49	50	40	38	21	28	35	35
SK	24	24	23	32	37	34	23	19	26	22	24
MB	18	20	7	26	19	17	19	14	15	15	19
ON	48	52	39	41	40	44	29	26	26	43	48
Total	126	133	116	148	146	135	109	80	95	115	126

Table 4 shows the number of accidents on a normalized unit of measure of per million main-track train-miles. This data was only available for all of Canada. This means there is an upward bias in the numbers because many of the busiest road-rail crossings are in Canada's most populous Provinces in the east and not at all along the corridors/routes in question.

Table 4 – Crossing Accidents per Million Main-track Train-miles, Canada[3]

Crossing Accidents per Million Main-track Train-miles											
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Canada	2.5	2.2	2.1	2.3	2.2	2.1	2	1.6	1.7	1.9	1.9

Table 5 shows the number of highway crossing accidents in the US states that are likely to be involved in any rail shipments from Western Canada or from the Bakken oil fields. This data has been limited to serving carriers in this corridor/route, CN, CP, BNSF, and their US subsidiary railways. Again, this data takes in all accidents within the state and not just in the corridor route and therefore is biased higher.

Table 5 – Highway Crossing Accidents US Corridor Railways[4]

Highway Crossing Accidents											
State	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
IL	2	6	4	3	5		6	5	7	7	3
MI	2	1	1	1		4	1	3	3	1	1
MN	3	1	1	2	5	4	2	5	3	3	1
ND	2	2	3	4	2		1	1	2		3
Total	9	10	9	10	12	8	10	14	15	11	8

[2] Table derived from Transportation Safety Board of Canada data (34). Includes all crossings in a province.
[3] Table derived from Transportation Safety Board of Canada data (34). Data not available by province.
[4] Table derived from US Department of Transportation data (33) for only potential rail carriers in the corridor.

We see no discernible change in the number of accidents per year along the corridor/route despite the considerable variance in crude oil shipments in the corridor, as discussed in the rail capacity section 4.1.2.1.

Contrary to the Rennicke Report, there is no indicated increase in safety risks with at-grade rail crossings should Line 5 capacity be replaced with rail.

4.2 Conclusion Two: Markets are Efficient and Will Move to Fill the Void

Whenever there is a void in the marketplace, market players will move quickly to fill the void. We can easily see that with the previous discussions on the growth of crude-by-rail terminals in both Canada and the United States.

During my years in the commercial realm of transportation, I have seen this play out repeatedly across many industry sectors and commodities. There are numerous companies that exist solely to take advantage of different types of opportunities in the marketplace. They can be very broadly classified into three groups but very often the lines of business will overlap.

I have classified and listed but a few of these companies below as examples of parties that have existing assets and capabilities and that could move very quickly to take advantage of any void in the marketplace. They and many others also can quickly add facilities and capabilities.

4.2.1 Marketers – Commodity Traders

Some companies have assets that they can deploy on very short notice to take advantage of voids in the marketplace and arbitrage opportunities. These are generally, but not always, referred to as "marketers", "commodity traders" or "arbitrage players".

They most often will take positions in the marketplace, buying and selling commodities and delivering the product on short term contracts. They are expert in finding a supply of product in one market and delivering it for a profit in another.

Examples:

1) Macquarie Group of companies, worldwide commodity traders[5]
2) Trafigura group of companies, worldwide commodity traders[6]
3) Elbow River Marketing, North American marketer/trader, transporter of propane, crude oil, asphalt[7]

[5] Details see: https://www.macquarie.com/ca/en/about/company/commodities-and-global-markets.html (39)
[6] Details see: https://www.trafigura.com/products-and-services/ (38)
[7] Details see: https://www.elbowriver.com/services/ (40)

Many producers of a commodity will market their own products and others. Shell Marketing and Cenovus Marketing are good examples.

4.2.1.1 Tidal Energy – Enbridge's Rail Service Provider, NGL/Crude Oil Marketer

Tidal Energy Marketing and Tidal Energy Marketing (U.S.) LLC is a very interesting player in this segment. " With over 20 Years of Marketing Experience, Tidal is a full service Crude Oil, Condensate, NGL, Natural Gas and Power Marketing Company. Tidal is a wholly owned subsidiary of Enbridge and supports many of the Enbridge network assets." (10)

Tidal's NGL and Crude Oil marketing arms boast their skills using rail and setting up facilitates to enable getting hydrocarbon products to market. Indeed, Tidal was one of my larger NGL clients when I was the Director of Sales at CN. They had an NGL railcar fleet used to facilitate trading and marketing of propane and butane in Canada and the United States.

4.2.2 Terminal Developers/Operators

Other companies will take the longer view and will contract over longer terms of 5 to 10 years or even longer. They generally don't take positions in the marketplace but will enable others to do so as they can deliver on long-term logistics and market supply strategies. These are companies that primarily provide logistics and facilities to move products to and from the market. They will build facilities such as ports, rail loading and unloading facilities, warehouses, tank farms and so on.

Examples:

1) Vopak, marine and tank terminal specialists, worldwide[8]
2) International-Matex Tank Terminals (IMTT), rail and marine terminals, Canada and United States
3) USD Group, rail terminals, railcar fleet, tank storage, Canada and United States[9]

4.2.3 Midstream Companies

This group is basically a combination and an expansion of the other two groups. A big part of their activities involves transportation facilities and logistics, marketing/trading commodities and oil and gas processing facilities.

There are many large players in this segment with massive assets. They have large balance sheets and experience that allow them to build facilitates quickly. These companies are always looking for new opportunities. A Line 5 winddown would be a very large opportunity for them.

Some examples are:

[8] Details see: https://www.vopak.com/tank-terminals (41)
[9] Details see: https://usdg.com/our-network/ (42)

1) Keyera: fractionation facilities, condensate facilities, rail terminals, rail car fleets pipelines, US and Canadian operations[10]
2) Enterprise Products Partners: fractionation facilities, marketing, rail fleet, marine terminals, tank storage, US operations[11]

4.2.3.1 Pembina – An Important Player in the Market

Pembina Pipeline Corporation is one such player, and it is a very important one. It has massive unit train capable rail yards connected to propane and butane fractionation facilities. It also owns pipelines and a marine terminal. (11) One important pipeline it owns is the Cochin pipeline that has "…future potential to connect the eastern leg of the Cochin Pipeline System to Pembina's assets and markets in Sarnia, Ontario." (12) The Cochin pipeline opportunity will be discussed later.

Pembina has existing incremental fractionation and rail capacity to ship more propane and butane into US Markets. It has the ability for brownfield expansion at its Redwater (located in the greater Edmonton area) fractionator. (13 p. 30)

Pembina's focus is to provide higher customer netbacks (gross profits per barrel) by providing "…access to premium markets with higher customer netbacks." (13 p. 30) We could expect then that, should markets open up, propane will shift to those markets providing higher netbacks.

Companies like Pembina could certainly form part of the propane solution should Line 5 winddown.

Pembina now owns the, very large unit train crude-by-rail terminal in the Greater Edmonton area (formerly owned by Kinder Morgan) that is capable of up to 3 unit trains a day. (14) This facility is pipeline connected and typically ships unit trains of crude oil from Imperial Oil to Exxon's refinery in Baton Rouge, LA. This facility certainly has the capacity to ship to other Imperial Oil facilities such as the refineries in Sarnia and Nanticoke, Ontario that are now served by Line 5.

5 Economics and Logistics of Crude-by-Rail

As previously discussed, the Rennicke Report focuses only on a segment of the total costs to ship crude by rail versus pipelines. Not only does this lead to an incorrect assessment, but it also masks the other opportunities to create capacity in existing pipelines. When I started the crude-by-rail segment for the rail industry starting in late 2007, the misconceptions of the Rennicke Report were common in the industry.

However, as we can see from the growth of the industry over the years since then, the market has come to understand both the costs and benefits of using crude by rail.

[10] Details see: https://www.keyera.com/operations/ (35)
[11] Details see: https://www.enterpriseproducts.com/operations (37)

I have made numerous industry presentations in Canada and the United States since 2008 about the economics of crude by rail. Many in the industry have since adopted these economics (15) or variations to justify building many crude-by-rail terminals of all sizes. I have directly negotiated long-term, take-or-pay contracts with shippers both while at CN and Altex Energy that justified the investment of hundreds of millions of dollars in crude-by-rail terminals. Others have done even more.

The key point to keep in mind, as I have said to many senior oil company executives, is that pipeline tolls do not represent the entire cost of getting crude oil to market – especially as it relates to heavy crude oils.

The focus, although not exclusively, in the following section is on heavy crude oil. Although it is my understanding that heavy crude oils have been moved out of Line 5 into Enbridge's Line 78, the following report sections will show how more capacity can be created in Line 78. As discussed in Section 7.1, one of the transport options in the event of a Line 5 shutdown is to increase overall capacity on Line 78 by moving the heavy crude currently transported through Line 78 to rail, thereby freeing up that capacity and more for light crude oil.

5.1 Oil Types and the Effect on Transportation Logistics

A common misconception, especially among lay people, is that all crude oil is basically the same product. But nothing could be further from the truth. Crude oils have different characteristics and different uses in the overall diet of crude oils that the refineries process. Most importantly, the type of oil transported has a profound effect on transportation costs and safety requirements for transport.

5.1.1 Oil Type Classifications – Pipelines

For pipelines, there are basically three classifications of oil or four if you include condensates. They are generally classified as to their density per cubic meter at a temperature of 15C.

The following classifications are from the Enbridge FERC Tariff 45.27.0 (16 p. 2) also referenced by the Rennicke Report. With some rare exceptions (e.g., hot bitumen pipelines), these classification characteristics do not change from tariff to tariff, pipeline to pipeline:

1) Light Crude Petroleum (Light)
   - Density 800 kg/m^3 up to but not including 876 kg/m^3
   - Viscosity from 2 mm^2/s up to but not including 20 mm^2/s

2) Medium Crude Petroleum (Medium)
   - Density 876 kg/m^3 up to but not including 904 kg/m^3
   - Viscosity from 20 mm^2/s up to but not including 100 mm^2/s

3) Heavy Crude Petroleum (Heavy)

- Density 904 kg/m³ up to but not including 940 kg/m³
- Viscosity from 100 mm²/s up to but not including 350 mm²/s

4) Condensates (CND)
   - Density 600 kg/m³ up to but not including 800 kg/m³
   - Viscosity from 0.4 mm²/s up to but not including 2mm²/s

5.1.1.1 Pipeline Tolls Vary by Crude Type

Because it is more costly to move heavier and more viscous (sticky) crudes, pipelines charge more depending on the type of crude. Table 6 shows Enbridge tariff FERC 45.27.0 for shipping crude and condensate from the Edmonton terminal inlet to the Sarnia terminal. This is the tariff that the Rennicke report uses for its pipeline versus rail economics.

This table shows the cost going up as the oil gets heavier and more viscous. There is an 18% increase in the toll from the lightest to the heaviest oil.

Table 6 – Enbridge Tariff FERC 45.27.0 – Cost by Oil Type (16)

International Joint Transportation Rates in US Dollars per Cubic Meter & per US Barrel[12] Edmonton Terminal Alberta to Sarnia Terminal, Ontario			
CDN	Light	Medium	Heavy
$35.6116 m³	36.5641 m³	38.5809 m³	42.1148 m³
$5.66 bbl	$5.81 bbl	$6.13 bbl	$6.70 bbl

The Rennicke Report did not consider the different costs in moving different types of oil in its analysis. Indeed, the analysis only used the cheaper rate of $5.88 US/bbl (1 p. 69). *(Rate difference from $5.81 in the above table likely due to precision factors with converting from cubic meters to US barrels).* It also did not take into account other cost factors that are listed in 4.1.3 and discussed later in this report.

5.1.1.2 Quality Restrictions: Density and Viscosity

Pipelines, with some rare exceptions (e.g., hot bitumen type pipelines), do not accept crude oils exceeding a certain density and viscosity. According to Enbridge's Rules and Regulations tariff CER 499, it will not accept any crude with a density exceeding 940 kg/m³ and a viscosity of 350 mm²/s (17 p. 5).

The reason that pipelines restrict density and particularly weight is because it becomes impossible to transport this sticky (high viscosity) heavy oil any appreciable distance in a pipeline.

5.1.1.2.1 Lowering Density and Viscosity – Adding a Diluent

[12] One cubic meter equals 6.28981077 US barrels (oil)

Heavy crudes at the point of production far exceed the density and viscosity requirements of the pipeline. For example, heavy crudes produced in the Lloydminster, Saskatchewan area will have a density in the range of 985 kg/m³ (~12 API). Heavy crudes (bitumen) from the Ft. McMurray, Alberta area can exceed 1,000 kg/m³ (~<10 API).

To meet the heavy crude pipeline specifications, these heavy oils are diluted. They are most commonly mixed with condensate or in some cases synthetic oil (referred to as diluents). The ratio of heavy oil or bitumen to diluent is typically 70% oil 30% diluent. The resulting mixture is often referred to as "dilbit".

There is a significant cost for the diluent which will be discussed later. This is referred to as the "diluent penalty". Again, the Rennicke Report fails to capture these costs.

5.1.1.3 Quality Restrictions: Water and Sediment, Temperature

When crude oil is produced, it contains a certain amount of water and sediments. Pipelines require that the oil be processed to remove water and sediment down to 0.5% by volume (17 p. 5). This not a requirement of any refinery buying the oil. It is a pipeline transportation requirement.

The reason for this requirement is that water and sediments have a corrosive effect on the pipeline and its components.

Many producers of heavy crude oils keep their oil in heated insulated tanks prior to transport to the pipe inlet. The oil will be kept typically in the range of 75C to lower the viscosity for pumping and transport. According to Enbridge's Rules and Regulations tariff CER 499, it will not accept any crude with a temperature exceeding 38C (17 p. 5).

5.1.2 Cost Effect of Oil Type Classifications and Quality Restrictions - Pipelines

The Rennicke Report did not factor in any of the costs associated with these oil types and quality restriction costs when shipping crude oil by pipeline. None of these costs are captured in the pipeline costs shown in Exhibit B-1 (1 p. 69) of the Rennicke Report. These costs, however, can be very significant. And, importantly, these costs are not necessarily incurred when shipping by rail as will be discussed later.

For example, to meet the pipeline specifications, the oil must be processed at facilities such as those operated by Secure Energy[13]. The oil will typically be trucked from the well to the processing facility and, once processed, trucked to the pipe inlet.

The trucking costs and processing costs amount to dollars per barrel. I will account for much of these costs in my economics comparison later in this report.

[13] Details see: https://www.secure-energy.com/fluids-and-solids-equipment?hsLang=en (43)

In contrast, oil being shipped by rail does not need any particular processing. Often, producers can remove enough water and sediment on site to meet refinery requirements. The buyer and seller settle the quality difference on a commercial basis which saves each party money. In my experience, the economic cut-off for water and sediment is 2% by volume for rail shipments (again, the cutoff is 0.5% for pipeline transport).

5.1.3 Oil Type Classifications - Rail

Rail has no particular requirement or restrictions on the oil characteristics that can be shipped. The oil just needs to be classified correctly to meet Transportation of Dangerous Goods (TDG) regulations and to be loaded into the qualified rail car type.

For these reasons, crude oil shipments on rail are often categorized as follows.

1) Heavy - Undiluted crude
2) "RailBit" - Under diluted heavy crude
3) "Dilbit" – Fully diluted heavy crude that meets pipeline specifications.
4) Light – Any other crude

Heavy and railbit crudes will need to be shipped hot in coiled and insulated (steam jacketed) cars. Unlike pipelines, oil heat is a benefit to shipping by rail. No cost is required to cool it.

The other crudes can and should be shipped in uninsulated non-coiled rail cars for best economic results since the weight of the steam coils and insulation will reduce the amount of oil that can be carried.

The Rennicke Report does not account for the variation in lading[14] amounts due to oil type.

5.1.3.1 Transportation of Dangerous Goods - Differences

When crude oil is shipped on rail, it is required to be properly classified and placarded. In Canada, heavy undiluted crude can be classified as asphalt which is not a regulated commodity for TDG purposes. However, since most heavy crudes are exported to the US, even asphalt is a regulated commodity.[15]

Nevertheless, heavy crude oil leaving Canada is not identified at all as crude oil. It is identified as *Heavy Fuel Oil, #6 Fuel Oil, Bunker C.* Its proper shipping name is *Combustible liquids, NOS* and will carry an NA1993, Class 3, placard when shipped (18).

[14] "Lading" is a transportation term meaning the load of freight that is being carried or capable of being carried. For example, a railcar may have a gross weight on rail of 286,000 lbs. This is the empty weight of the car itself and the lading (commodity carried) combined. The empty weight of a railcar (or truck) is called the "tare" weight. If the railcar tare weight is 90,000 lbs then the lading (or load) weight could be up to 196,000 lbs.

[15] TDG Regulations in Canada and the US are subject to reciprocity. Meaning the TDG rules of the origin country apply when traveling in the destination country. This does not apply to a handful of commodities. Asphalt is one of them.

The other types of crudes will be identified as some of type crude oil and will be placarded, for example, as a UN1267 or UN3494, Class 3 and identified as *Flammable* (19). These are considered more dangerous products to transport primarily because of their flashpoint temperature.

Flashpoint is the product temperature at which the product will emit vapours that can ignite. In the case of heavy oil and bitumen, the flashpoint is between 60C and 93C (18) (water boils at 100C). The other types of crude will have a much lower flashpoint. Generally, the more diluent the lower the flashpoint. For example, even an under diluted bitumen (railbit) will have a flashpoint in the range of -8.5C (16.7F) (19).

The Rennicke Report does not account for the decrease in safety (due to increased flammability) and increased cost of adding the diluent required for transporting heavy crude on a pipeline (1).

5.2 A Case Study in Understanding More Fully the Cost of Rail vs. Pipe

In 2016, I published a case study based on years of research to show more fully the cost of shipping a barrel of heavy oil (or bitumen) on rail versus pipeline (15). This case is still published on Altex Energy website (20).

There are three basic concepts that must be understood when comparing the economics of shipping heavy crude oil of bitumen by rail versus pipeline.

1) Normalization of units shipped
2) The diluent penalty
3) Embedded costs that aren't readily apparent

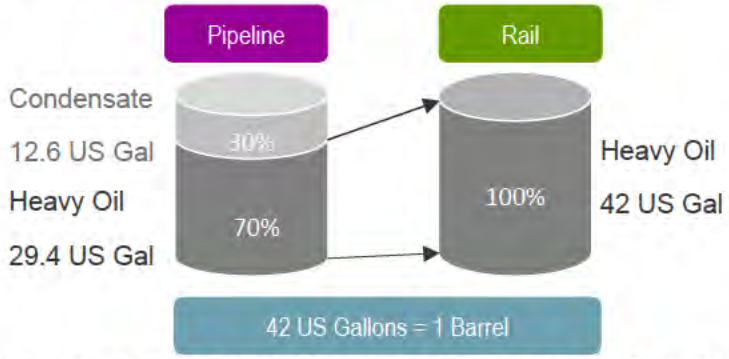
I have already discussed some of the embedded costs and have included many of them in the case study. Many of these costs also apply to shipping any kind of crude on a pipeline.

5.2.1 Normalizing the Units Shipped

I will be using different pipeline tolls for different origins and destinations later in my case study, but for this illustration I will use the tolls from the pipeline tariff used in the Rennicke Report as shown in Table 6.

One of the biggest misunderstandings is in comparing shipping a "barrel" of oil on pipeline versus rail. In order to ship one barrel of heavy oil on pipeline, it must be diluted as previously discussed.

Figure 1 – Rail and Pipeline Barrel Comparison

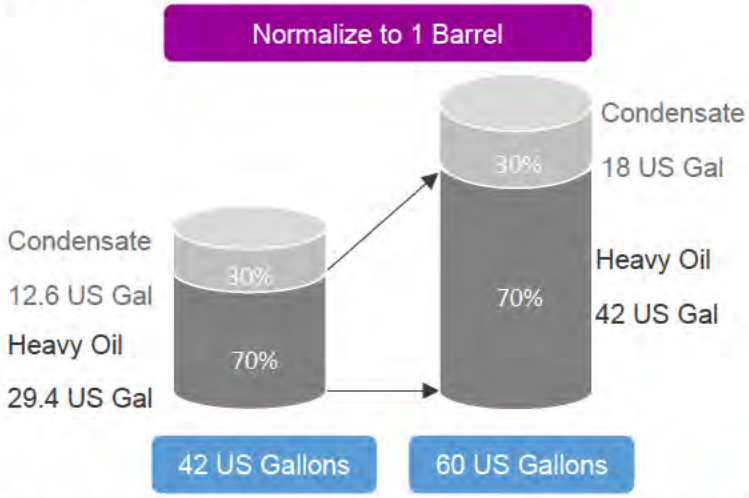


One US barrel is 42 US gallons. However, as Figure 1 shows, one pipeline barrel of heavy crude (dilbit) is only 29.4 US gallons of actual heavy crude, and 12.6 US gallons is condensate.

As Figure 2 shows, in order to move one barrel (42 US gallons) of heavy oil in a pipeline, it would require 18 US gallons of condensate. The total dilbit blend would then be 60 US gallons

Pipeline tolls are quotes in per barrel or per cubic meter for moving crude oil. There are two ways to look at the costs of moving one barrel of heavy oil.

Figure 2 – Normalizing to Barrel of Heavy Oil



Since the Rennicke Report only looked at the cost of moving light oil, it did not consider either of these methods.

5.2.1.1 Method 1 - Normalizing the Pipeline Toll

Method one is the easiest to understand. Since pipeline toll of $6.70 per bbl (see Table 6) would only move 70% of a barrel in this blend ratio, simply divide the toll by 0.7 which would give a normalized toll of $9.57 per bbl.

5.2.1.2 Method 2 - Adding the Diluent Transport Cost

Method 2 calculates the cost to move the diluent portion of the normalized barrel. Since it requires 18 US gallons of condensate to move 42 US gallons of heavy oil, the cost to transport the condensate (diluent) portion is 18/42 * $6.70 = $2.87. Adding $6.70 for the heavy oil portion, the cost is $9.57 per bbl which is the same number arrived at in Method 1.

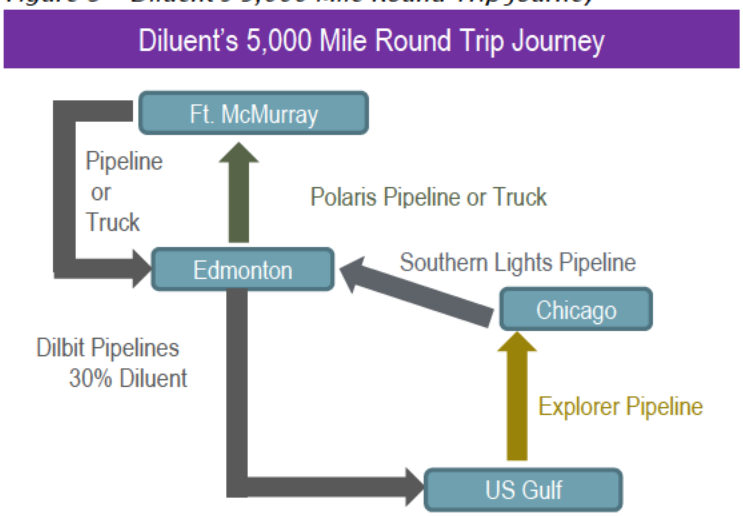
5.2.2 The Diluent Penalty

For the purposes of my case study, I look at the cost to move a barrel of heavy crude or bitumen from Fort McMurray, Alberta to the US Gulf Coast. The concepts are the same, however, for shipping heavy crude on Line 5 or Line 78.

Since heavy oil is not produced in the great Edmonton area, the origin point for heavy oil at the Edmonton inlet of these pipes is from areas well north of Edmonton moving through and to the Ft. McMurray area. In addition, imported condensate (diluent) largely comes from the US Gulf Coast and goes into the Edmonton diluent pool. From there, it moves into the production field for blending and/or for use in steam assisted gravity drainage (SAGD) oil producing operations for water removal.

The diluent penalty costs can be grouped as follows:

Figure 3 – Diluent's 5,000 Mile Round Trip Journey



1) The cost to move the diluent as part of the dilbit mixture from origin to destination. In this case either by pipeline or truck to Edmonton (or Hardisty) and then pipeline to the USGC.
2) The cost to strip the diluent out of the oil at destination.
3) The cost to ship the diluent from the destination back to the diluent hub such as Edmonton either by pipelines or rail.
4) The cost to ship the diluent from the diluent hub back into the field to the producer either by pipeline or truck.
5) The differential loss between the price paid for the diluent at the diluent hub (West Texas Intermediate "WTI" price basis) and what it is sold for as part of the dilbit blend at the pipeline inlet in Edmonton (Western Canadian Select "WCS" price).
6) Losses in transport and handling throughout the entire logistics chain.
7) The time value of money while the diluent is in the system.

This round-trip cycle occurs over and over again in pipelines but can be completely avoided with rail. *However, if a dilbit mixture is shipped by rail it will be subject to the same diluent penalty costs.*

5.2.2.1 Cost of the Diluent Penalty – Differential Loss

The cost of transporting diluent as part of the dilbit mixture has already been shown in the Normalization calculations. This part of the diluent penalty can be calculated more precisely since it is just a function of the ratio of diluent to bitumen and the pipeline toll.

What is more difficult to understand and often shows the inefficiency of the system is the loss between what it costs to buy diluent from the Edmonton pool and what the dilbit mixture sells for at the pipeline inlet in Alberta. This is called the "differential loss".

Oil sells in Alberta at the pipe inlet at price called Western Canadian Select (WSC). Condensate (C5+, diluent) is sold in Edmonton, generally at West Texas Intermediate (WTI) prices.

The price difference between WCS and condensate pricing varies over time and is market based. One way to understand this differential is to look at the cost to transport diluent from the USGC to Edmonton. The cost to buy diluent in Edmonton should at least be the cost of diluent in the USGC plus the cost of transport on the pipelines as shown in Figure 3 to get the diluent to Edmonton.

In general, in my experience, a reasonable average differential over time is about $12.50 US/bbl. Currently, as of April 1 close, the WCS, Condensate (C5+) differential is $11.41 US/bbl (WCS $87.86, WTI $99.27, C5+ $99.27) (21). Again, these prices will vary over time, but I use $12.50 for my case study.

In any case, this cost must be normalized to the cost to move one barrel of bitumen which would be 30/70 * $12.50US = $5.36 US (or April 1 close 30/70 * $11.41 = $4.89 US/bbl).

The Rennicke Report did not include the differential loss costs in its calculations of pipeline versus rail costs (1 p. 69). Adding the normalized cost per barrel of $9.57 to the $5.36 diluent penalty, the cost is now $14.93 US/bbl by pipeline.

5.2.2.2 Cost of the Diluent Penalty – Transport Cost from Diluent Hub to Field

Once the diluent arrives at the diluent hub, it needs to be transported to the production site in the field. In this case study, I am using the Fort McMurray, Alberta area. Regardless of the location of production, this is usually done via pipeline connection from the diluent hub or by truck.

In my 2016 case study, at the time I calculated the pipeline costs to be about $1.97 US/bbl and trucking costs to be about $6.12 US/bbl (15) (20). These costs would likely be higher now just due to inflation. Usually, the pipeline is used only for large producers and trucking is used for smaller producers.

Regardless of the production point in the field, there is some distribution cost to get the diluent to the point of production. Once production moves away from the Ft. McMurray area which is pipeline served, say into the Lloydminster area, trucking becomes the only option from diluent hubs. The Rennicke Report did not include any diluent distribution costs in its calculations of pipeline versus rail costs (1 p. 69).

The distribution cost must be normalized to move one barrel: pipeline $1.97US *30/70 = $0.84 US/bbl and truck: $6.12 * 30/70 = $2.62US/bbl.

When we add either of these costs to the normalized barrel cost and the diluent differential penalty ($14.93 US/bbl), we can see that the cost of using pipeline for heavy crude or bitumen exceeds rail costs ($15.16 US/bbl) calculated in the Rennicke Report (1 p. 69).

5.2.3 Embedded Costs Not Readily Apparent

There are other embedded costs to use a pipeline that aren't readily apparent and apply differently to different shippers. The following is a non-exhaustive list of some of those "hidden" items:

- Quality equalization, quality degradation[16]
- Batch interface commodity and transportation costs[17]
- Excessive treating costs to meet pipeline transportation specifications
- Time value of money
- Credit costs
- Loss allowances
- Batching and storage costs

The latter five of these items are discussed below.

5.2.3.1 Time Value of Money – Transport Time

A dilbit pipeline flows at about 2 miles per hour. Not accounting for batching, a shipment would take about 52 days to travel 2,500 miles. A unit train moving at an average of 25 miles per

Figure 4 – Time Value of Money Over Transport Time (15)

Time Value of Money Over Transport Time								
	Speed (MPH)	Distance (Miles)	Time (Days)	Batch Size Barrels	Sale Value Per Barrel	Cost of Capital (%)	Cost Over Transport Time	Cost per Barrel
Rail	25	2,500	4.2	60,000	$ 30.00	8%	$ 1,644	$ 0.03
Pipeline	2	2,500	52.1	60,000	$ 30.00	8%	$ 20,548	$ 0.34
						Incremental Pipeline Costs		$ 0.31

[16] Pipelines are "batch" systems. Different producers put different qualities of oil in the batch. There are formulaic mechanisms to try and adjust for the difference but often the lower quality producer benefits as the overall batch is better than what they contributed.

[17] When different commodities are shipped in batch, there is an interface product between them to segregate them from contaminating each other. The cost of the commodity interface and shipping it are borne by the shipper.

hour would traverse the same distance in just over 4 days. The time value of the money of oil in the pipeline is not insignificant and is about 12.5 times higher than rail.

The average distance for shipments on Line 5 are shorter in the Rennicke Report (1 p. 69) than those I used in my 2016 case study. I am using a very conservative number for the sale price of the oil that would more than offset this difference. In any event, the point is that there is a cost associated with transit time differences between rail and pipeline that the Rennicke Report ignored, not the exact cost for this scenario.

5.2.3.2 Batching and Storage

Pipelines charge terminaling fees for storage and throughput to create batches. A production rate of about 20,000 bbls/day (9,537 M3) would take about 3 days and 6 *Stream Days* [18]to build a 60,000 bbl batch which is about the same size as a unit train.

In my 2016 analysis of Enbridge's tank receipt and batching fees, this would add about $0.23 US/bbl (15).

5.2.3.3 Loss Allowance and Quality

Figure 5 – Loss Allowance Cost Example

Loss Allowance Costs					
	Oil Value $/bbl	Loss Factor	Normalize	Loss $/bbl	Normalized Loss
Dilbit	$ 40.00	0.05%	1	$ 0.020	$ 0.020
Diluent	$ 52.50	1.50%	3/7	$ 0.788	$ 0.338
	Loss Per One bbl of Bitumen Transported				$ 0.36

Because of the amount of handling of the diluent and dilbit, losses occur. Loss allowances vary from about 0.05% on dilbit pipelines to about 1.5% in condensate pipeline and truck systems. Figure 5 is an illustrative example that applies to heavy crude in particular but there are some loss allowances for all types of crude.

There are also formulas for product quality equalization that are outside of commercial seller-buyer negotiations which can lead to losses for certain producers. Since rail does not need diluent and because the product is segregated in each tank car, losses are minimized, and quality is a direct commercial negotiation between seller and buyer.

5.2.3.4 Excessive Treating Costs

As discussed in 5.1.1.3, pipelines require that oil meet certain specifications before it will be accepted for transport. In particular, the amount of water in the oil can not exceed 0.5%. As discussed in 5.1.2, for rail this is only a commercial consideration and not a transportation consideration.

[18] "Stream Day" is a term used in Enbridge tariffs for the number of days a product flow goes into storage to make a batch ready to ship on the pipeline.

The higher levels of water allowable by rail reduce treating costs and water disposal costs for rail transport as compared to pipelines. In some cases, the required level for rail can be achieved with field treating and thus reduce the cost of treating, including the cost of transporting oil to a treating facility and then to a pipeline terminal.

Additional trucking and treating alone can add up to dollars per barrel.

5.2.3.5 Total Estimated Embedded Costs

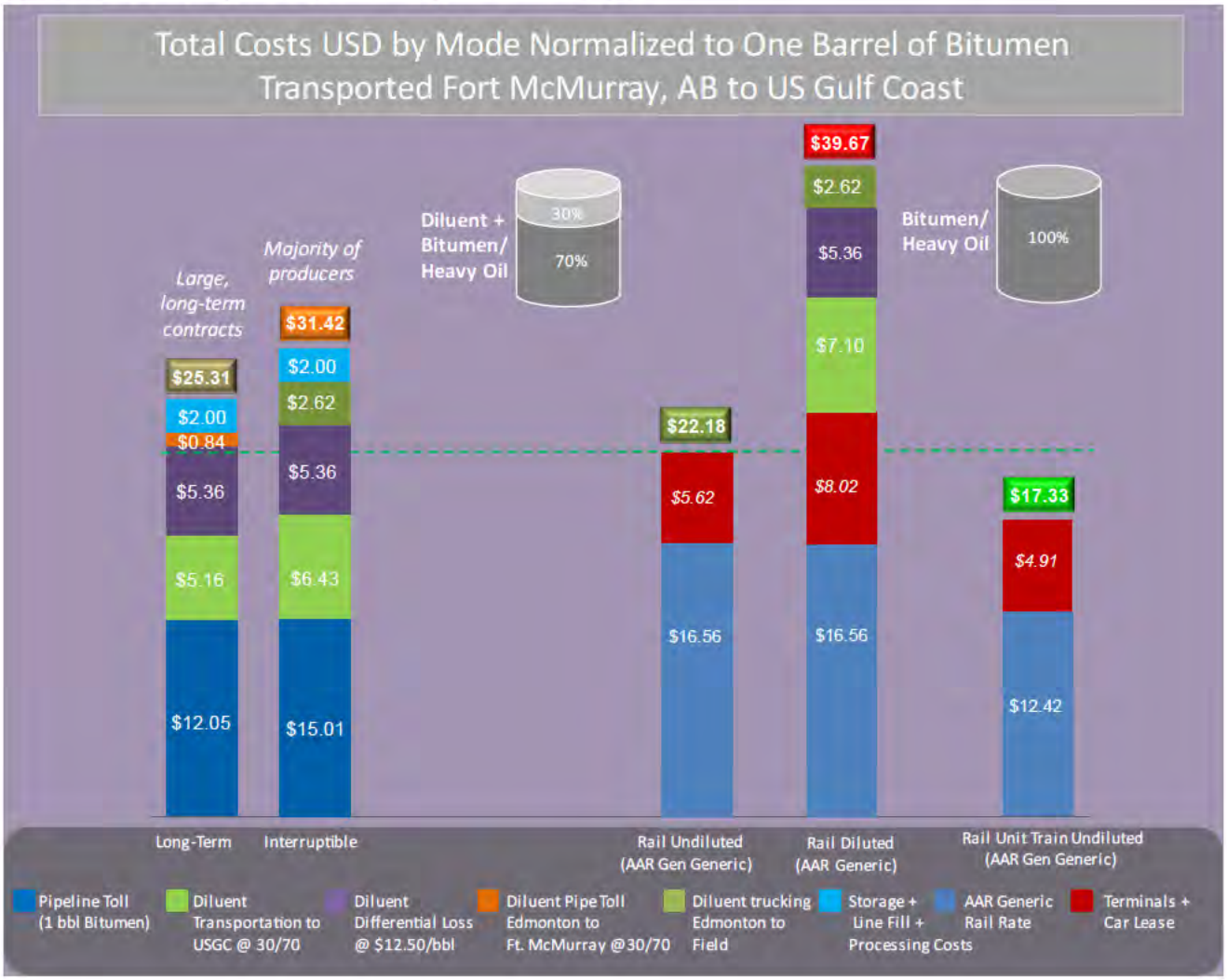
The illustrative examples given here are only for a portion of the costs and have been conservatively estimated. The point is not necessarily to come to an exact cost figure because these amounts change over time, with production locations and with new tariffs. The point is to show that there are significant costs embedded in the pipeline transportation system that are not accounted for by the Rennicke Report when doing a total cost comparison of rail versus pipeline for shipping crude oil.

In my case study, I conservatively estimate these hidden or embedded costs at $2.00 US/bbl (20; 15). These estimated costs exclude any quality equalization, quality degradation and batch interface product and transportation costs.

5.2.4 Case Study Findings

Using the methods previously discussed, available pipeline tariffs of the day for committed and non-committed shippers, and generic cents per ton mile from the American Association of Railways (AAR) at the time for rail rates, I compiled the chart shown in Figure 6 (15; 20). The AAR rail rates are non-negotiated rail rates for all commodities for all service types. Negotiated rail rates would be lower but I used the most public data available.

Figure 6 – Case Study Findings – Cost by Mode of Transport



Because the rail line to Ft. McMurray is only rated to 268,000 gross weight on rail (GWoR) versus the normal 286,000 GWoR, the costs for rail is penalized by 6.7%. Shipments originating from the Greater Edmonton area, Hardisty, Alberta or terminals in Saskatchewan and North Dakota would all be able to load to 286,000 GWoR.

The analysis shows the following:

1) It is cheaper to ship heavy undiluted crudes by rail either by manifest (single car) or unit train (100+ cars) than by pipeline
2) Shipping diluted crude by rail on its face is more expensive than pipelines
3) Interruptible pipeline rates, meaning for shippers who cannot enter into long-term pipeline contracts, is significantly more expensive than rail for shipping undiluted crude oil.
4) Even when the diluent penalty costs (diluent differential and transportation costs) that are not associated with light and medium crudes are removed from the equation, Figure 6 shows that the cost of unit trains of light and medium crudes is still competitive with the cost of interruptible pipe. This is especially true given that Figure 6 shows costs for cars that have a 6.7% lading disadvantage versus shipments that could replace Line 5 shipments.

5.2.4.1 Most Rail Shipments are by the Least Competitive Rail Option – Why?

The crude oil shipment statistics compiled by the Canadian Energy Regulator as discussed in 4.1.2.1, are for either diluted heavy, light, or medium oil. That's because as discussed in 5.1.3.1, heavy undiluted crude is not classified as crude oil. This means that the oil shipments as accounted for over the years by the Canadian Energy Regulator, including the peak of 412k bpd in February 2020, was for the least economic shipments of crude-by-rail.

As previously discussed, the large rail unit facilities owned by Pembina and USD Group, for example, are pipeline connected. Their shippers have signed long-term contracts that support the development of these terminals at a cost of hundreds of millions of dollars.

Why would any one support the least competitive rail transportation option, that is, the shipment of light and medium crude by rail?

The reasons will vary but my understanding is that their shippers, like Imperial Oil and Total, did not want to solely rely on pipelines.

Pipelines may have difficulty expanding and often suffer from apportionment. These and other shippers need to ensure that their refineries never go down for lack of oil or that production facilities are throttled back for a lack of egress. The net present value (NPV) of lost production can be enormous.

They also want to integrate their oil production in Canada with the refining capabilities in the United States. There are untold economics and business reasons for doing this.

The massive growth in rail facilities and shipments by rail from the U.S. Williston Basin, as shown in Table 2, is all light oil. More light oil is shipped out of this area by rail than by pipeline.

There are many reasons for this, but my understanding is the main one relates to well decline rates. Oil in this area is what is referred to as "tight oil". A well is not only drilled but it must be "fracked" (a high pressure splitting of the rock) to allow oil to flow out of tight shale rock formations.

These types of wells are prolific producers at first but then decline quickly. Wells need to be constantly drilled in other areas. This does not allow time for pipeline infrastructure to be set up nor can producers sign the long-term contracts to support the pipeline build out and loading facilities.

Rail carriers have very good existing networks through the Williston Basin that allow for easy set up of facilities on much shorter-term contracts.

In addition, once using rail, producers have access to the entire North American market and can avail themselves of all kinds of arbitrage and marketing opportunities. Pipelines simply don't offer the same market access and therefore the security of off-take.

Because rail is a "pull" system, rail will only ship to markets that are willing to pay. In other words, the markets will "pull" oil into them. Pipelines are more of a "push" system because of the tendency for long-term take-or-pay volume commitments on pipelines. Therefore, product is "pushed" into a market whether the market wants it or not, which has the effect of dropping the price of oil.

As we have seen, rail can be far more flexible, and the market uses rail to help regulate price.

The Rennicke Report does not discuss any of these factors but, as previously stated, only relies upon a rudimentary and incorrect analysis of one component of the transport cost. Clearly, the market disagrees with the conclusions of the Rennicke Report.

6 Market Changes Since Line 5 was Developed

The market has change significantly since Line 5 was built in the 1950's. There are four major developments that are of interest in this report:

1) The building of robust crude-by-rail infrastructure starting in early 2008
2) The development of hydraulic fracturing ("fracking") technology starting in the early 2000's (22)
3) Commercial Development of the Canadian Oilsands starting in the late 1960's (23)
4) Development of Steam Assisted Gravity Drainage (SAGD) technology in the late 1970's and first use in 2001 (23)

Prior to 2008, the Marcellus Shale gas fields in Ohio, Pennsylvania, New York and West Virginia. were thought to have little natural gas potential. It was known in 2002 that there were deposits of 1.9 trillion cubic feet of gas. Newer estimates put this number at 50 trillion cubic feet of recoverable gas (22). This makes the Marcellus gas field one of the largest in the United States.

Similarly, gas fields in northeast British Columbia (Montney, Duvernay and Horn River) once thought to be uneconomic prior to 2008 or so now have some of the largest gas plays in Canada. The Montney Shale gas field is estimated to hold up to 50 trillion cubic feet of natural gas (24).

Hydraulic fracturing ("fracking") technology made these and other gas fields economically viable and changed the supply point for natural gas and its component products, propane, and butane. Also, the British Columbia fields are known as "rich gas" formations. This means when the liquids from the gas well are processed, significant amounts of condensate (C5+) are recovered.

Although the Alberta oil sands started with a mining process, it wasn't until the invention and commercialization of the SAGD process that heavy oil/bitumen production really began to grow. The SAGD process also uses condensate to separate the oil from the water resulting from the steam used.

These technology changes profoundly changed the market for crude oil and NGLs. They brought on new supplies and from many different locations that did not exist when Line 5 was originally built in the 1950's. Some of these changes are discussed below.

6.1 Changes to Natural Gas, Propane and Butane Supply

Prior to the development of the Marcellus Shale gas fields and the associated gas processing and fractionation facilities, the US northeast market was supplied from Canada. Now the eastern Canadian market is supplied in part from the Marcellus.

6.1.1 Cochin Pipeline Reversal Due to Lack of Canadian Supplied Propane Demand

The Cochin pipeline used to bring pure propane into the eastern Canadian market prior to its reversal in 2013-2014 (6). Propane from the pipeline was loaded onto rail at the former BP rail rack, in Sarnia, Ontario, now owned by Plains Midstream, for final delivery into eastern Canada, Michigan, Ohio and other US northeast destinations. The demand for Canadian supply changed so much that the former owner of the Cochin pipeline, Kinder Morgan, having received no support from the propane producers, applied to have the pipeline reversed from Chicago to Edmonton (6).

The pipeline now brings in condensate to the Edmonton pool. The eastern leg from Chicago to Sarnia was not reversed.

6.2 Changes to Canadian Oil Production

As of January 2022, oil sands production (bitumen) made up 85.5% of all oil production in Alberta (25). Western Canadian non-oil sands heavy oil production is projected to grow from 54% in 2017 to 58% in 2023 (26).

Conventional light crude production has dropped by almost half from 1.2 million bpd in 2000 to about 650 thousand bpd and is not projected to reach about 700 thousand bpd until 2040 (26).

These data point to a lesser need for light and medium oil transportation and a greater need for heavy crude transportation in the coming years. Line 5 does not transport heavy crude at all, but Line 78 currently does. As discussed in Section 7.1 below, overall capacity on Line 78 may be increased by removing the heavy crude currently transported on it to rail (a cheaper option for heavy crude), thereby increasing the capacity for light crude transportation on Line 78 and the overall capacity of the pipeline.

6.3 Crude-by-Rail Meets Changing Oil Production

As previously discussed in Section 5, transporting undiluted heavy oil by rail is cheaper than transporting by pipelines and safer due to the characteristics of undiluted heavy oil versus diluted.

What has really changed from 2008 to now is the sheer number and capacity of crude-by-rail operations. This has had a profound effect in the marketplace. Most importantly, it has opened the possibility of developing more destination terminals for refineries. Previously, developing destination terminals may not have been economic since both origin and destination terminals needed to be built.

There is also the possibility of building more rail terminals that are pipeline connected at destination for local distribution. Jefferson Energy's terminal in Beaumont, TX is one example of a destination rail terminal that is both pipeline and barge connected for local distribution[19].

7 Potential and Current Market Responses

It is not possible to know all the current and potential market responses regarding a Line 5 shutdown but there are many. I will cite some examples here. These examples are not meant to be exhaustive, but they underscore how out of touch with market reality is the Rennicke Report's conclusion that the market will not adjust to take advantage of the opportunities presented in the event of a Line 5 shutdown

They key issue for developing any of these is Enbridge's Line 5 being the incumbent in the market. In my experience, it is very difficult to displace an incumbent because market players want a significant premium for switching to an alternative. This was the key issue when I developed crude-by-rail for example. Many of the identified opportunities may not yet have come to fruition for this very reason.

Going forward, because Enbridge holds out the possibility of Line 5 continuing, which may or may not happen, many market players have not made plans for the alternative. In my view, this is very risky. I have shown how others, like Imperial Oil in section 4.2.3.1, have set up alternative sources of oil supply to de-risk their operations.

[19] Details see: https://jeffersonenergyco.com/crude-oil/ (44)

7.1 Potential 1: Making Space on Enbridge's Line 78

The Rennicke Report states that some of the existing volume could be transferred to other pipelines but there would be a shortfall of 226.7K bpd of crude oil transportation (1 p. 17). The report does not say which pipelines some of this crude could be diverted to. I assume some portion of this volume is to Enbridge's Line 78.

In any case, volume on Line 78 can be increased by taking heavy oil out of it and putting it on rail. For every one barrel of undiluted heavy crude shipped by rail, 1.4 barrels of space could be created. This is because, as discussed in 5.2.1, the heavy oil must be diluted to move in a pipeline. Yet, it need not be diluted for transportation on rail. Moving one unit train of say 60,000 bbl of heavy crude to rail would create about 84,000 bbl of pipeline space for lighter oils.

In addition, heavy oil in a pipeline moves slower than lighter oils. When heavy oil batches are added into a pipeline, it slows down the pipeline which, in turn, reduces capacity. Moving heavy crudes to rail should help increase the speed of product being transported on the pipeline and thus increase capacity.

To summarize, moving the heavy crude currently transported by Line 78 to rail (a cheaper option for heavy crude) would then free up additional volumetric capacity on Line 78 for light crude, as well as increase the speed at which the light crude can reach its destination and hence further increase capacity.

7.2 Potential 2: Husky's Toledo Refinery Supply by Rail from Bruderheim

In 2009, I worked on a project with CN for Husky's Toledo (and Lima, OH) refinery to be supplied with crude oil from their proposed oilsands Sunrise Project. We had proposed a terminal in CN's Toledo, OH railyard with a short pipeline connection to the refinery.

At the time we were competing with oil supply moving in over the Great Lakes from West Africa and pipeline – presumably Line 5. Likely because crude-by-rail was new and unproven at the time; Husky chose not to proceed with the rail option.

As discussed in section 6, the market has significantly changed since then. Husky has since merged with Cenovus. Cenovus owns a large unit train-capable and pipeline connected-facility in Bruderheim, AB (Greater Edmonton area). It has its own leased rail car fleet (27).

The Bruderheim rail facility could supply some portion of the Toledo refinery's heavy crude diet leaving space on Line 78 for any lighter oils needed in the refinery diet. Alternatively, lighter oils could be shipped by rail from Bruderheim to Toledo, OH.

7.3 Potential 3: Create or Expand Rail Receipt Capacity at Refineries

Some refineries like Suncor and Valero in Quebec have rail facilities already. Valero at one time shipped unit trains of diesel or jet fuel into Toronto. Refineries can increase their capacity to receive rail.

The rail facilities do not have to be right on refinery property. They can be connected to a rail terminal by a short pipeline. Alternatively, the rail terminal can be located near existing pipelines and feed product into those pipelines. This is exactly what happens with many crude-by-rail facilities in the US Gulf Coast.

7.3.1 Imperial Oil Sarnia, Ontario Example

Imperial Oil in Sarnia, ON is another good example of the potential for creating rail receipt facilities. In 2013-2014, Imperial Oil began to develop its crude by rail capabilities (28) starting with the large facility in the Greater Edmonton Area as discussed in 4.2.3.1. This development also included a receipt facility for their Baton Rouge, Louisiana refinery.

A short time later, Imperial explored the possibility of supplying by rail other refineries it had, including the refineries in Sarnia and Nanticoke, Ontario. In Sarnia, the plan was to receive unit trains from the US Williston Basin[20] and primarily its Edmonton facility. A third-party rail service provider, VIP Rail, would manage the switching and unloading of the trains for Imperial Oil.

VIP Rail has comprehensive rail logistics capabilities, including switch, transloading, car storage and car cleaning (29). VIP Rail is the leading provider of these services in Sarnia and services most of the petrochemical facilities in the area. It has 160 acres of heavy industrial zoned land available for development in the heart of Sarnia's chemical valley (30).

VIP Rail has direct connections with CN and CSXT railways. This provides alternative paths and capacity for crude oil and propane to arrive in Sarnia.

[20] A part US Williston Basin is often referred to as the Bakken.

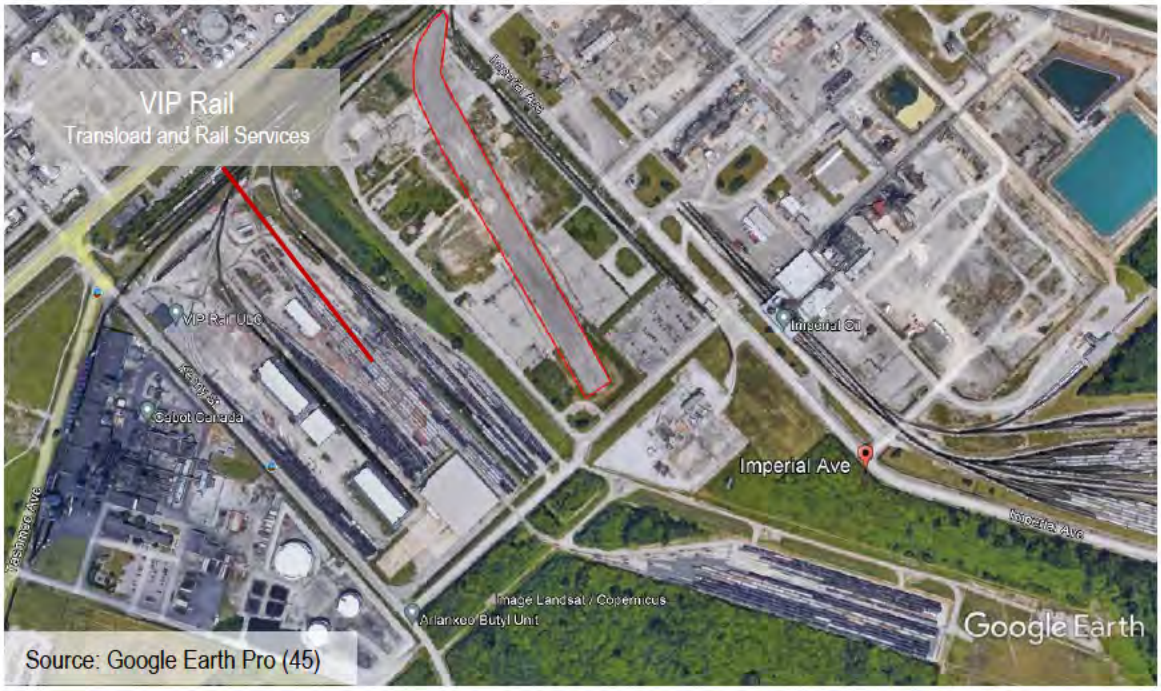
Imperial Oil had its own land available and began the preparations for building the crude oil unloading facility in 2014. Figure 7 and the close-up view in Figure 8, show that the Imperial Oil land has been prepared for track to be laid and rail unloading racks to be installed.

Figure 7 – Imperial Oil, Sarnia, ON – Prepared Rail Site

Figure 8 shows the location of some of VIP Rail's facilities. With Imperial Oil's land already prepared and with VIP Rail's ability to perform the unloading and rail car switching services, a facility here should be very quick to start up.

The Rennicke Report assertion that "*… there is a lack of loading and unloading terminals …*" and that in any case even if they could be built it "*… would be hard to find enough land and impossible to obtain the required environmental permits*" is clearly incorrect (1 p. 19). Imperial Oil already has a large unit train loading facility in the Greater Edmonton area, and it has land already zoned for heavy industrial (refinery) purposes in Sarnia. VIP Rail has additional heavy industrial zoned land available if necessary.

Figure 8 – VIP Rail: Rail Services



Source: Google Earth Pro (45)

7.4 Potential 4: Alternative Propane Supplies

There are numerous sources of propane in the US. Many new facilities, especially in the Marcellus gas fields have been built that can supply propane. There are existing rail facilities in Mont Belvieu, TX and Conway, KS. As previously discussed, Pembina has excess capacity to supply propane to United States markets.

Most propane is currently delivered by rail already. To the extent that any additional facilities for unloading might be needed, there are firms that specialize in quickly setting up these terminals. For example, Superior Midstream Services[21] has built numerous facilities (31).

Figure 9 – Portable Propane Transloader

Source: Superior Energy Systems, LLC. Used with permission.

[21] Portable transload picture used with permission from Superior Energy Systems, LLC. Details see: https://superiornrg.com/midstream/

The fastest facility to set up is a portable transload. Short line railways in Michigan, for example, would be an ideal place to set these up. All that is needed is a roadway and a piece of track.

One candidate to set these terminals up and acquire propane supply might be Enbridge's own rail subsidary Tidal Energy.

7.5 Potential 5: Cochin Pipeline

The east part of the Cochin pipeline from Chicago into Sarnia was not reversed. Pembina has stated that this part of the pipeline could be connected to other Pembina assets to supply Ontario markets (12).

One other possibility for shippers on Line 5 would be to negotiate with Pembina to reverse the western part of the Cochin Pipeline. As mentioned before in 4.1.3.1, two of the reasons the Cochin pipeline was reversed was because there was no demand for propane in the east, and it could not compete with rail or other pipelines. No rich gas producers committed to send rich gas to fractionators in the east for processing either (6).

The business case and reason given the Canadian Energy Board for the reversal was that the importation of condensate to Canada was expected to increase dramatically, especially with the expectation of the Keystone XL and Northern Gateway pipelines being built.

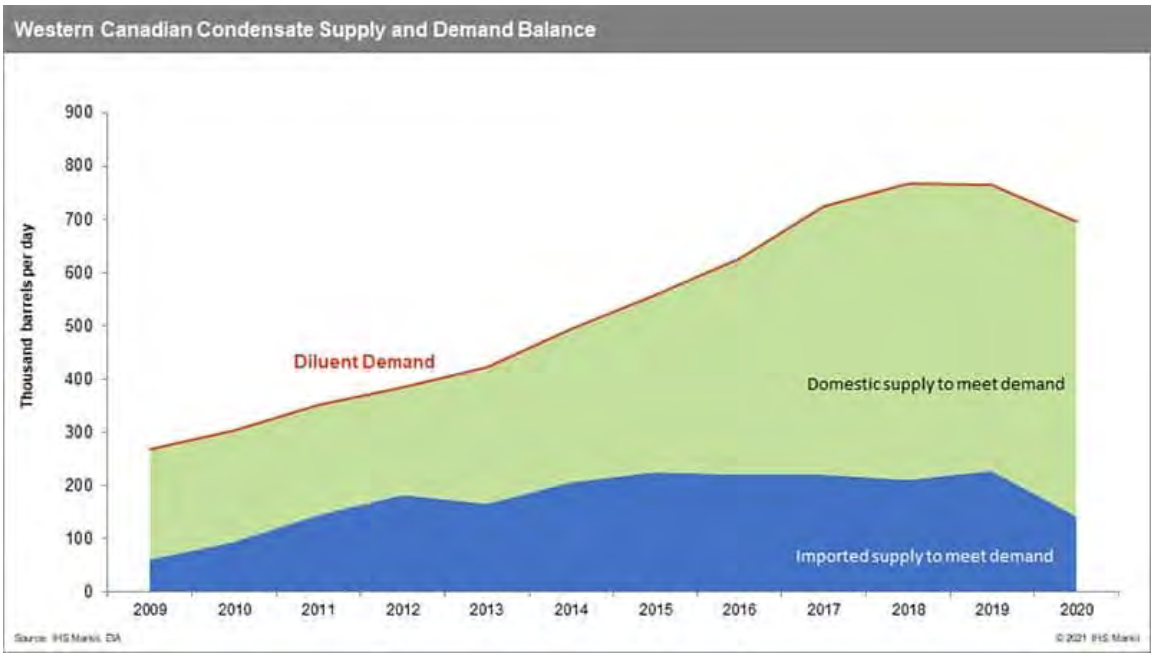
What happened though was that neither of these pipelines were built. Therefore, the demand for condensate diluent for these heavy oil pipelines never materialized. More importantly, as previously discussed, the markets changed, and Canada began to produce hundreds of thousands of barrels a day more condensate from the liquids rich gas fields in British Columbia and Alberta.

Figure 8 (32) shows the result is that imports of condensate peaked at about 54% of supply in 2012. Imports have dropped to about 125,000 bpd in 2019 or about 18% of supply.

The condensate imports come mainly from two pipelines although there are some rail imports. According to the Canadian Energy Regulator, Pembina's Cochin pipeline has a capacity of 95,000 bpd and Enbridge's Southern Lights has a capacity of 180,000 bpd (32) for a total of 275,000 bpd in pipeline import capacity.

This means that these pipelines are operating at about 45% of capacity. In addition, the total pipeline capacity has never come close to being fully used. It is possible to remove all of Cochin's condensate capacity and there still would be 55,000 bpd excess capacity available.

Figure 10 – Western Canadian Condensate Supply and Demand Balance



It would seem a reasonable proposition for shippers concerned about not having gas supply for fractionation to approach Pembina to reverse the pipeline once again. Based on the 10-year contract lengths that the previous owner, Kinder Morgan, was seeking to reverse the pipeline, these contracts are likely coming due about now (6).

7.6 Current: New Refined Products Terminal in the GTA

I have been working with a party that is building a large, refined products storage and rail terminal in the Greater Toronto, ON Area (GTA). It is under construction now and should be in operation by year end.

They are importing gasoline and diesel by ship into a year-round port on the St. Lawrence River and transporting it by rail to the GTA terminal. Rail cars will be unloaded into storage tanks. Trucks will be loaded from these tanks for local delivery.

The size of this terminal and its expansion capabilities (1 billion litres, 264M US gallons) were determined in part by the expected shut down of Line 5 and an unrelated anticipated shut down of the Shell refinery in Sarnia.

8 Final Summary

Summarizing this report, I believe that I have shown:

- That it is possible to move the commodities from Line 5 to a combination of rail, increasing Line 78 capacity, and other supply points
- The economics and benefits of crude-by-rail are more sophisticated than the Rennicke Report understands
- There are potential project opportunities to enable moving all of Line 5 commodities to rail
- The markets have changed since Line 5 was built and maybe some of the company's facilities connected to Line 5 are no longer competitive or have competitive alternatives to their products.
- The market will move to fill the void of a Line 5 winddown. There are many companies with the capacity and capability to fill the void
- Rail has the proven capacity to replace Line 5
- Rail is a safe alternative
- Rail facilities are relatively quick to build and not difficult to permit
- Prudent refinery operators have alternative supply points

Third Rail Group

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Appendix B – Randy Meyer – CV/Portfolio

Submitted under separate cover.