

Northern Baja LPG - Sourcing Options Economic Analysis



:

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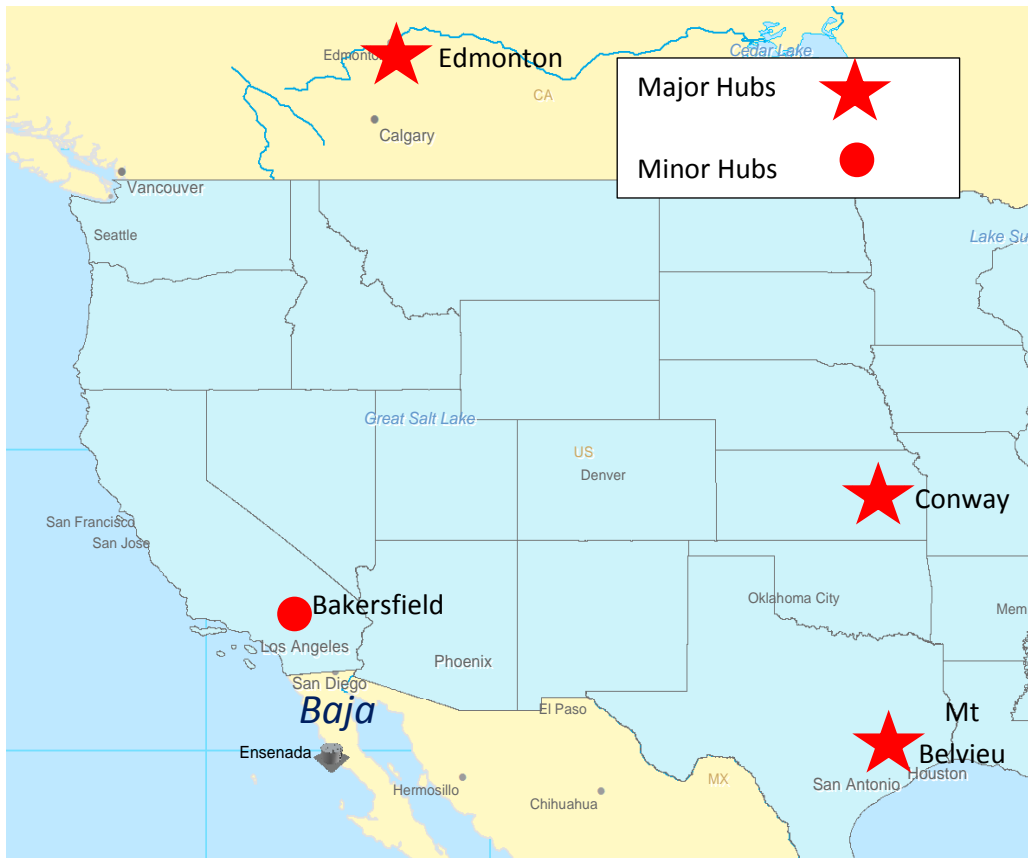
Introduction

This paper discusses the options for delivering LPG to northern Baja, Mexico from US sources.

Historically northern Baja has been supplied by US propane and butane. The products have been supplied to Tijuana and Mexicali via truck or rail. As the import system has been changed by PEMEX over the last few years, there has been an opening of the market to additional US and Canadian participants.

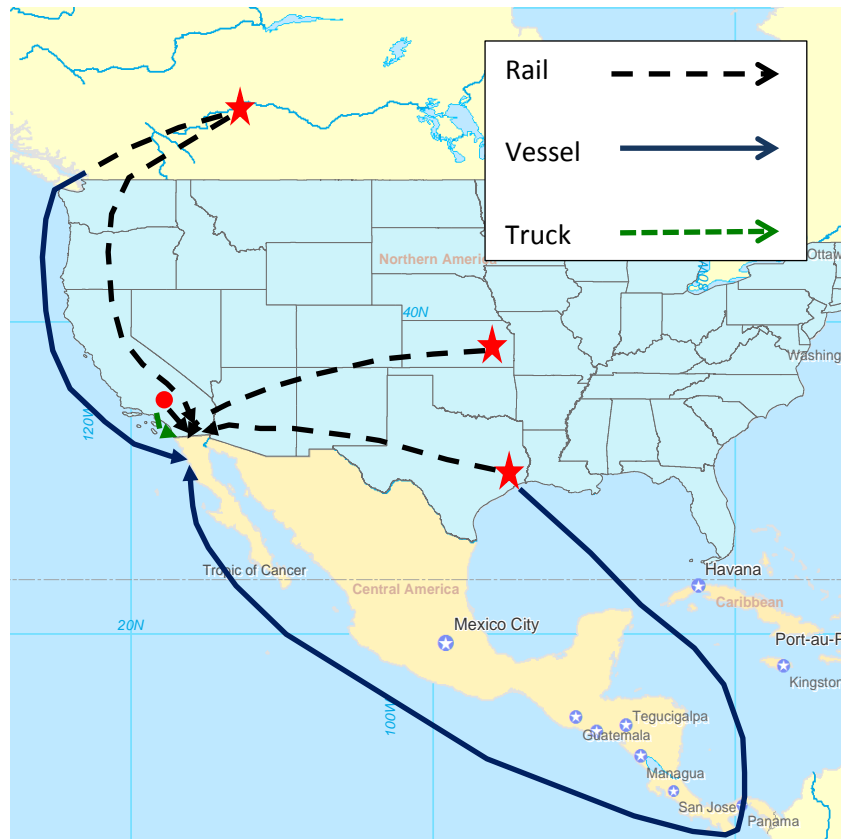
This study does an economic analysis of the competitiveness of the options of providing LPG from four different North American sources by different modes.

The four sourcing points are Mt Belvieu (PEMEX benchmark), Conway, Edmonton, and Bakersfield.



The following lanes to northern Baja were evaluated:

Lane	Mode(s)
Mt Belvieu- Ensenada	Vessel
Mt. Belvieu-Tijuana	Rail
Conway-Tijuana	Rail
Edmonton-Ensenada	Rail/Vessel
Edmonton-Tijuana	Rail
Bakersfield-Tijuana	Truck
Bakersfield-Tijuana	Rail

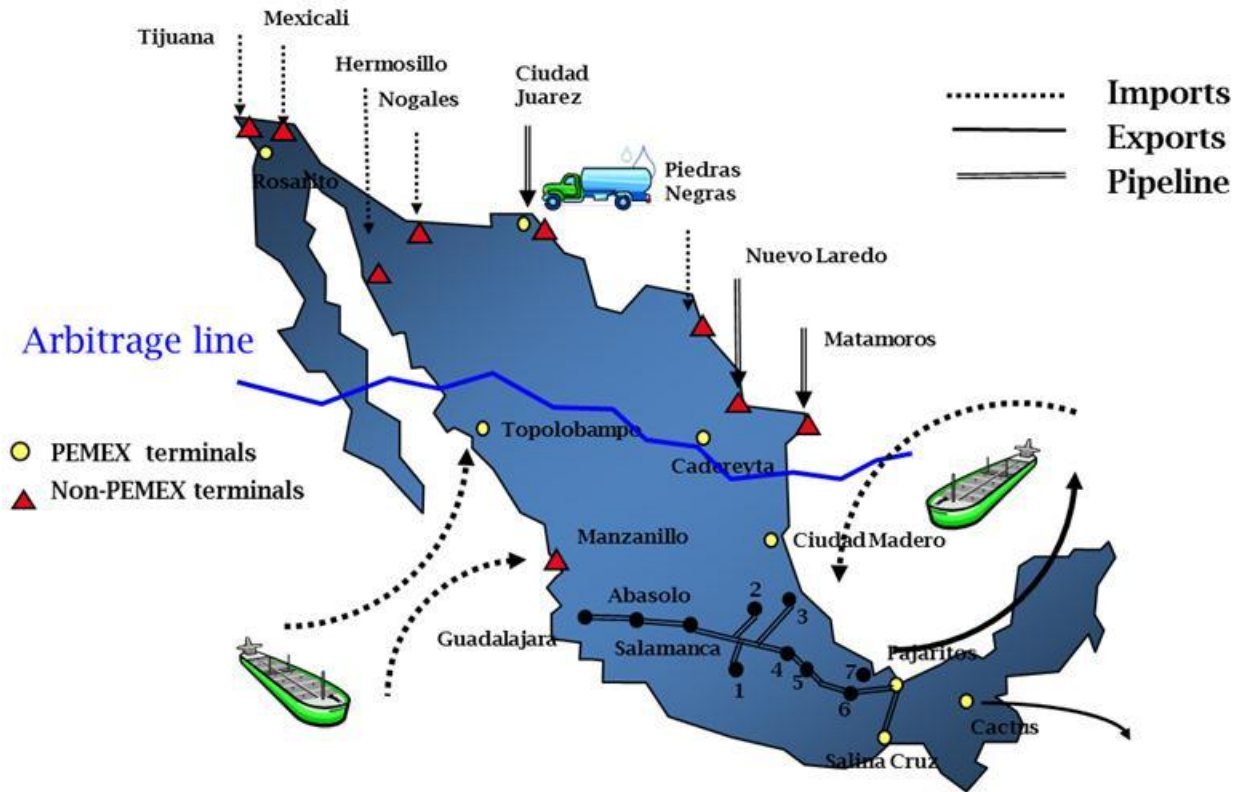


Three cross border land options are also evaluated; rail direct to Tijuana/Valle Redondo, rail to Mexicali then truck, and rail to National City CA then truck across the border.

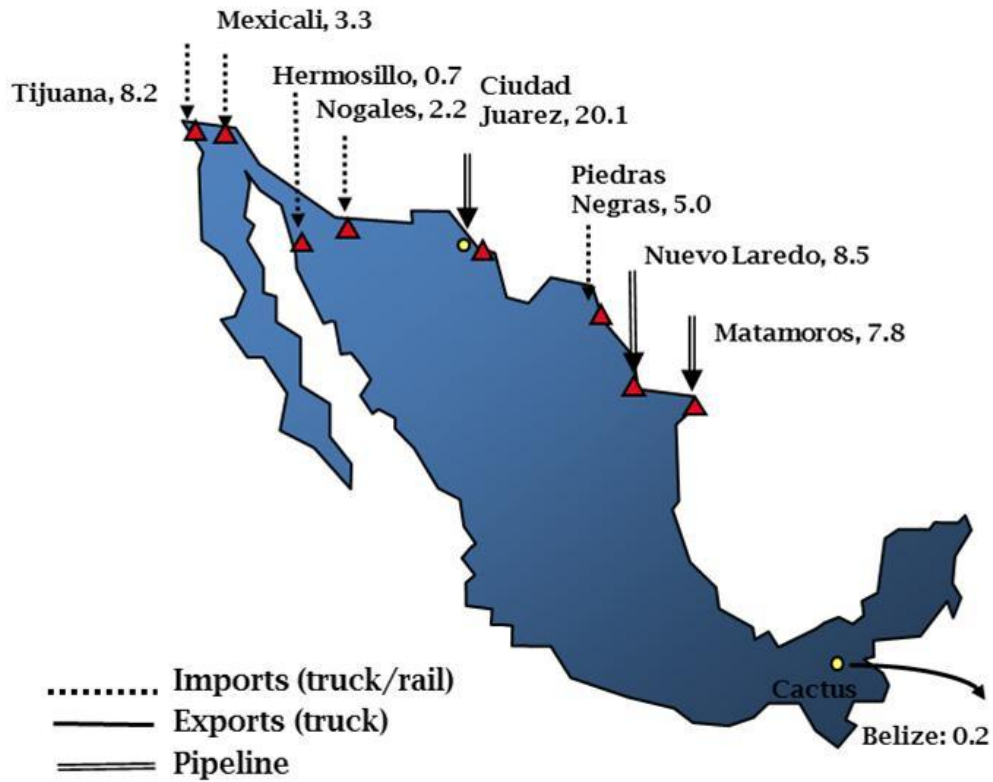
Northern Baja LPG Demand

Pemex 2006 figures for imports were about 11.5k barrels per day of LPG which is equal to approximately 5,900 carloads per year.

Estimated total volume is 2012 is 15 million gallons per month.

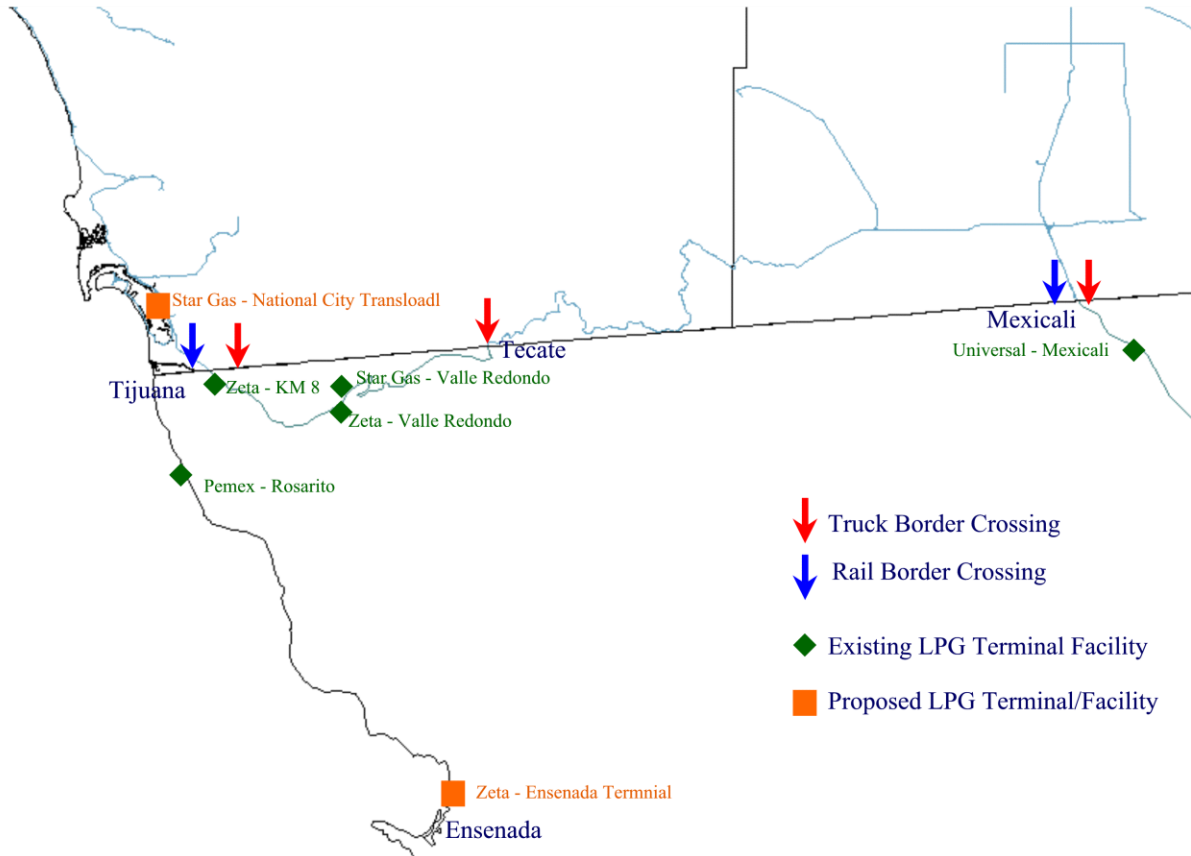


2006 Imports (kbpd) – PEMEX



Using Bureau of Transportation Statistics value data and converting into gallon equivalents, total demand for 2008 and 2009 was approximately 16,250,000 gallons or 6,500 carload equivalents.

Northern Baja California LPG Distribution



Breakdown by crossing and mode for average monthly volumes 2008/2009 is in the table below:

	San Ysidro	Otay Mesa	Mexicali	Total
Truck	0	5,000,000	1,250,000	6,250,000
Rail	7,500,000	0	2,500,000	10,000,000
Total	7,500,000	5,000,000	3,750,000	16,250,000

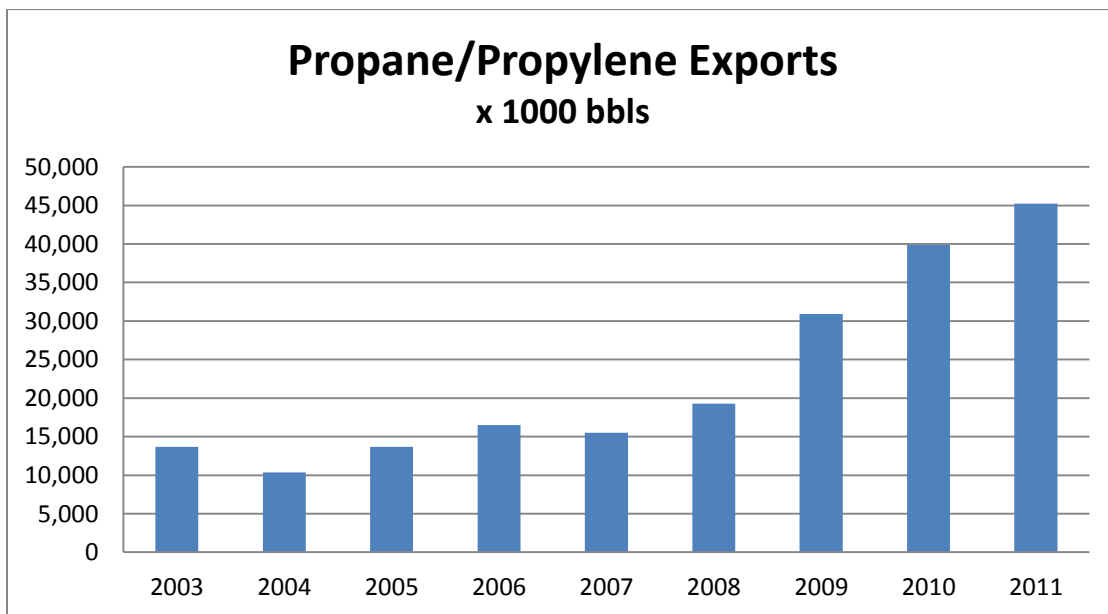
Demand and movement of LPG into Northern Baja is seasonal. Volumes during the summer are typically 70% of those during the peak winter months of December through March.

In 1979, Pemex became the sole importer of LPG into Mexico. All movements of LPG into northern Baja are controlled by Pemex who establishes quotas for each supplier in April of each year. In 2003, the consumer price for LPG was fixed throughout Mexico by Pemex.

In order to increase income from the fixed price contracts, suppliers will typically move LPG from the least expensive source, or buy in large volumes during the summer when spot prices are lower and place the LPG into storage for later distribution when market prices are higher. During the summer months when demand is lower and prices are less at LA basin refineries, the suppliers will truck or rail LPG from these producers. As the consumption increases and the prices climb higher, the suppliers usually have to obtain LPG from producers that are more distant, putting a strain on truck resources and usually resulting in a greater percentage of the carloads moving by rail.

Current Developments in US LPG Production

The recent increase in shale production of crude oil and natural gas has led to dramatic increases in domestic NGL production which has resulted in the increase of xx exports. To accommodate the substantial increase in export volumes, projects are underway on the US Gulf Coast (USGC) to build export terminals which would handle Very Large Crude Carrier (VLGC) type vessels. There is already a large LPG marine terminal in Manzanillo Mexico for import. A facility of similar size is under construction which when completed could serve northern Baja. These infrastructure improvements along with sufficient export capacity in the USGC could result in the displacement the existing rail moves into northern Baja.



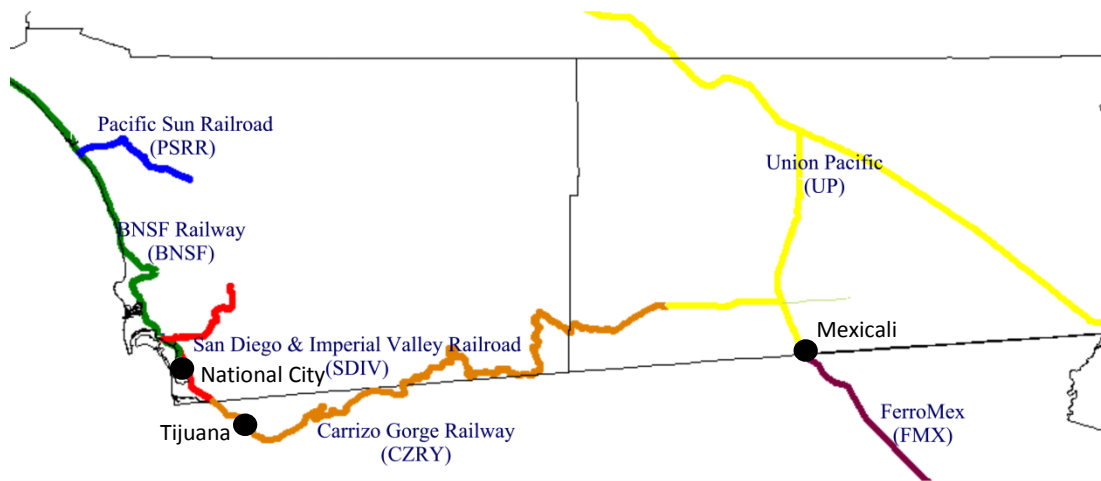
Northern Baja Rail LPG Facilities

There are four rail served facilities operating in northern Baja. In addition, there is one transload facility in the US at National City CA which can serve northern Baja by truck. The capacity of each facility is shown below.

Facility	Capacity		
	Carloads	Mil Gals	Metric Tons
Zeta – KM8	4,000	120	248,000
Zeta – Valle Redondo	2,000	60	124,000
StarGas Valle Redondo	2,000	60	124,000
Universal - Mexicali	2,000	60	124,000
<i>StarGas – Nat'l City Transload</i>	1,500	45	93,000

Although direct rail service is provided to the four facilities in northern Baja, this routing may not be the least costly. Between BNSF in San Diego and Baja there are two short lines which combined adding at least \$1,500 to the move. The move to Mexicali also provides an additional railroad and a longer trucking distance to Rosarito. A competitive transloading fee at the National City transloading terminal would make that the least expensive transportation option to the PEMEX Rosarito terminal.

Freight Rail Operators



The former Carrizo Gorge Railway (CZRY) is now operated by the Baja Railroad (BJRR)

Details on each rail terminal are below.

Zeta Gas – Tijuana KM 8



The Zeta Gas Tijuana facility is the primary distribution facility for Zeta Gas in Northern Baja. It was the original rail served terminal.

The site is in central Tijuana on the rail main line at KM 8. The facility consists of two tracks. There is an unloading manifold with a sixteen car capacity, and storage capacity for an additional 25 cars.

Fixed storage consists of eight storage tanks.

Spot capacity on the manifolds is approximately 4000 carloads per year. Operational capacity would be limited by unloading time per car.

Traffic in downtown, congestion, and rail layout makes this facility constrained.

All rail to this facility moves via BNSF.

Zeta Gas – Valle Redondo



This facility is located on the rail mainline at KM 34. It was built around 2003, and provides additional capacity to support the other Zeta Gas facility at KM 8. It was the second rail served terminal in Tijuana.

No details were available on manifold capacity, estimated capacity is 8 cars. Storage capacity is about 40 cars.

There are 12 fixed tanks at this site.

All rail to this facility moves via BNSF.

Star Gas – Valle Redondo



The Star Gas facility is located at KM 34 on the rail mainline directly across from the Zeta Gas facility.

It was built in 2005 and was the third Tijuana rail served terminal. It has manifold capacity for 8 cars, and storage capacity for approximately 40 additional cars. There is a Trackmobile on the facility which could be used to increase throughput at the facility by doubling the number of cars processed per day at the manifold from 8 to 16.

There are for storage tanks at this site. There is an on-site LPG bottling facility.

All rail to this facility moves via BNSF.

Universal - Mexicali



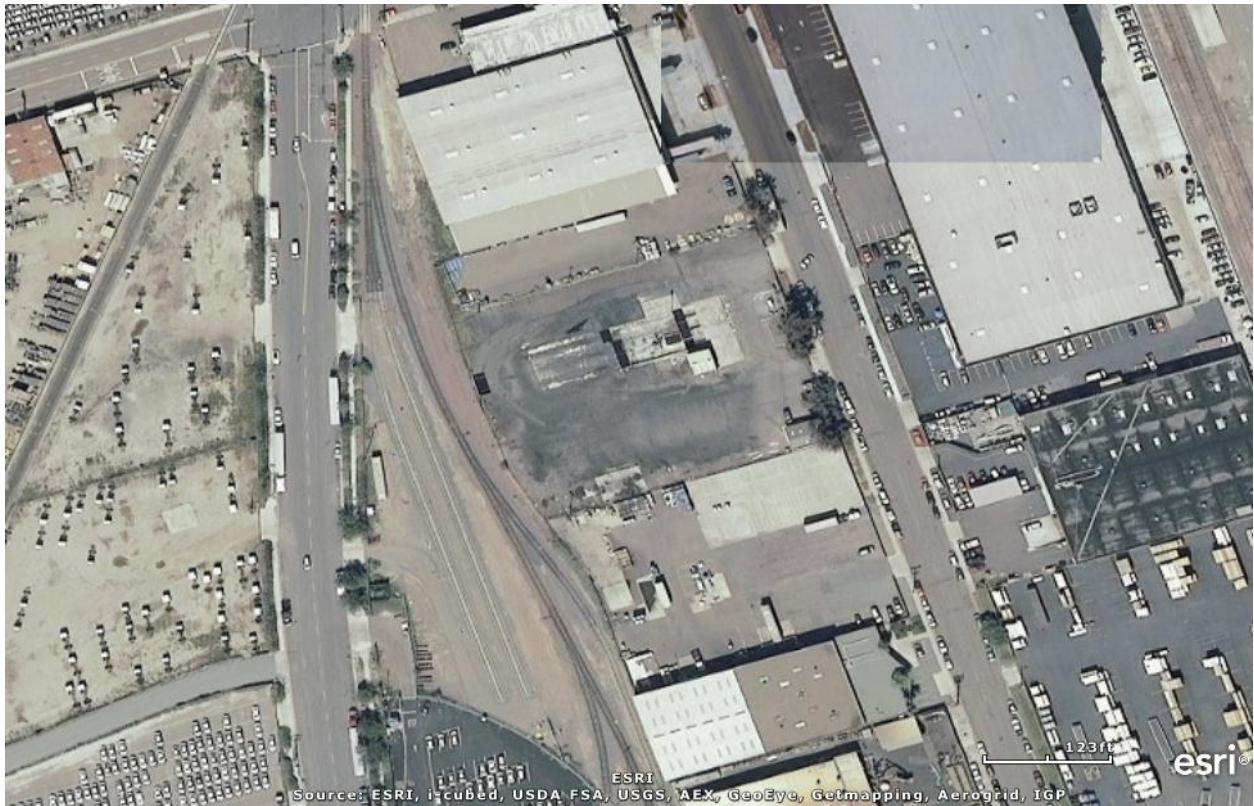
This facility is located on the Ferromex main line south of Mexicali at KM 5. This is the major LPG supplier in the Mexicali area.

The facility consists of two tracks of the mainline. There is estimated manifold capacity of 8 cars, and approximately 25 cars of storage. This facility unloads approximately 1,000 carloads per year.

There are twelve storage tanks on site.

Rail to this facility moves via the UP interchange at Mexicali. However, approximately 50% of the carloads are sourced on the BNSF at Zuni, NM, and Artesia, NM.

Star Gas – National City Transload



This site is located in National City, CA, approximately 3 miles south of the BNSF San Diego rail yard.

The operation uses two tracks with a total capacity of six cars. The railcars are transloaded directly to truck using portable LPG transfer pumps mounted on trailers. There is no car storage associated with this facility.

This is presently considered a temporary facility and there are no fixed storage tanks.

The facility became operational in November 2011.

Northern Baja LPG Marine Facilities

Zeta Gas Marine Facilities

Ensenada is the primary facility which would serve Northern Baja. There is a similar facility already operating in Manzanillo.

The PEMEX terminal at Rosarito has a barge facility which is out of service.

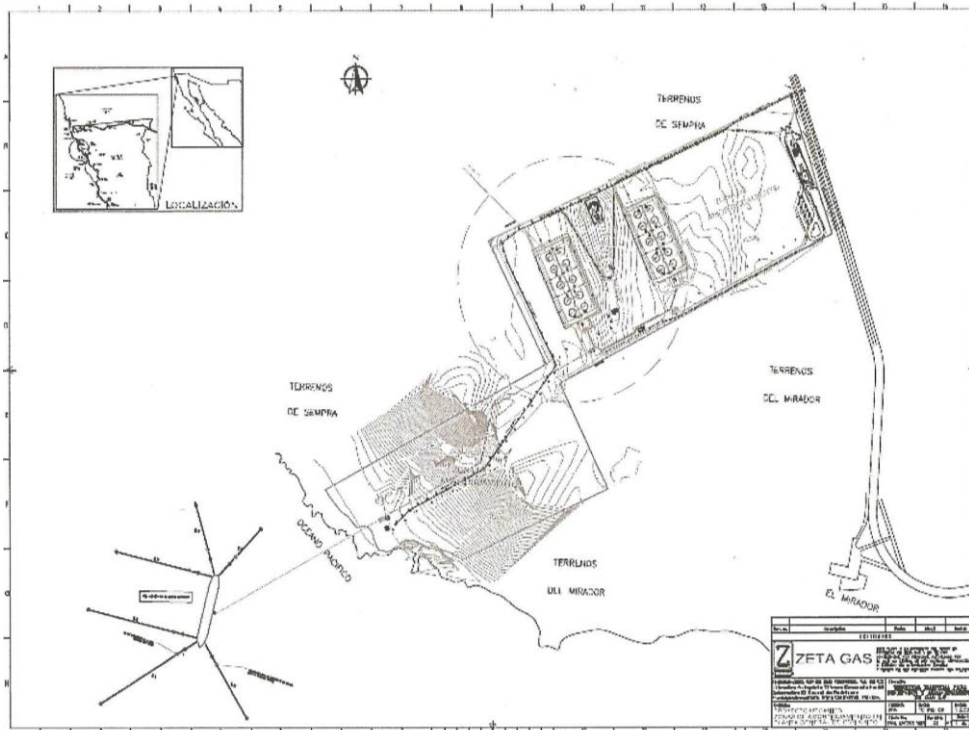
		Est. Volume (gal/mo.)	Storage Capacity (gal.)
Manzanillo	Mexico	12,600,000	36,000,000
Ensenada	Mexico	tbd	36,000,000

Manzanillo

The facility consists of 16 LPG and four propane spheres each of 1,820,000 gallons for a total facility capacity of 36,400,000 gallons. The plant is designed to receive a flow of 23,500,000 gallons per month and an outbound loading capacity of 420,000 gallons per day.

Ensenada

This new terminal consists of 12 LPG and eight propane spheres each of 1,830,000 gallons for a total facility capacity of 36,640,000 gallons. The vessel mooring location is connected to the storage facility by 14" pipe which is 6,600' in length.



US Rail Loading LPG Facilities

There are sufficient LPG rail loading facilities at all of the hubs under study. They all have multiple rail loading facilities and are served by multiple railroads.

BNSF Railway has direct service to Mt. Belvieu, Conway, and Bakersfield. BNSF indirectly served Edmonton via an interchange with Canadian National (CN) at New Westminster and with Canadian Pacific at Coutts, AB.



Tank Car Loading Racks – Targa Facility Mt. Belvieu



Plains Bakersfield Loading Facility

US & Canadian LPG Marine Terminal Facilities

Currently, there is an estimated 200 Mb/d of U.S. LPG marine export capacity, the majority of which is located along the Houston Ship Channel. By 2016, USGC propane and butane exports are expected to reach about 400 Mb/d, which has prompted two expansions to existing export terminals as well as plans to build two new terminals.

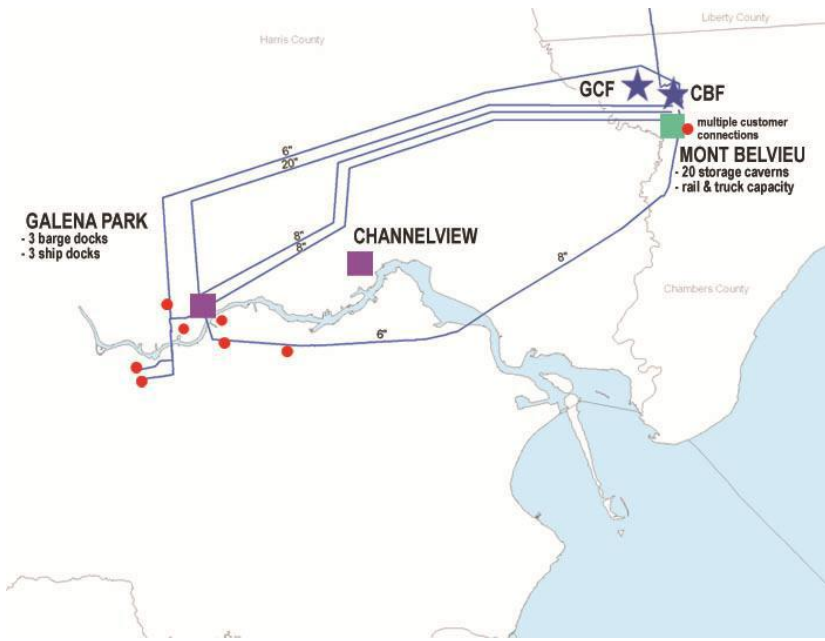
There are presently only two LPG export terminals in the Gulf coast; Enterprise at Houston and Targa at Galena Park. Current export capacity is 4.5-5.0 million barrels per month (189 to 210 million gallons).

Two additional USGC LPG terminal projects are under consideration.

Conoco/Occidental/TransMontaigne is developing a terminal on the Houston Ship Channel with a capacity of 240,000-480,000 bbl per day (10 million to 20 million gallons per day). This facility would be operational in 2014. Vitol is developing a 100,000 to 200,000 bbl facility near Beaumont (4 million to 8 million gallons per day). This facility is planned to be operational in 2013.

There are presently no LPG export facilities in western Canada. However, there are some LNG facilities permitted and under construction. If the present demand in the central US for Canadian LPG becomes constrained due to excess supply, it is highly likely that Canada would explore exporting to the Asian market using Very Large Gas Carriers (VLGC). This would prompt the development of an LPG export terminal near Kitimat, Prince Rupert, or Vancouver BC.

Targa Galena Park Marine Terminal



LPG Vessels & Maritime Economics

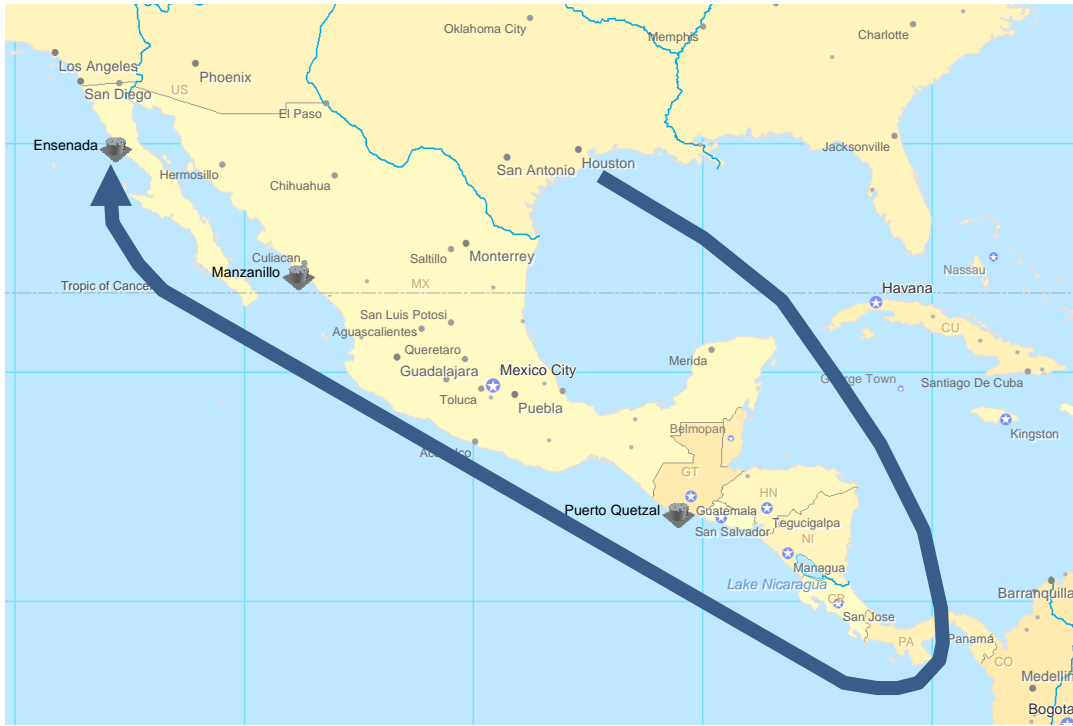
Movement by vessels is different than the other modes in that the cost per gallon declines rapidly depending upon the volume of the vessel. As many of the costs are fixed, there are scale advantages to moving LPG by a larger vessel. The primary limitations are the draft of the receiving terminal, and the existing Panama Canal width restrictions (USGC moves). Those restrictions will be lifted when the Canal expansion is completed in 2015.

Typical LPG Vessel Characteristics

Type		Capacity CBM (M3)	Capacity (gals.)	Storage
Very Large Gas Carrier	VLGC	>60,000	>15.8 mil	Refrigerated
Large Gas Carrier	LGC	45,000-60,000	11.8-15.8 mil	Refrigerated
Medium Gas Carrier	MGC	30,000-45,000	7.9-11.8 mil	Refrigerated
Semi-Refrigerated		10,000-30,000	2.6-7.9 mil	Semi-refrigerated
Pressurized		<10,000	<2.6 mil	Pressurized

Type		Capacity CBM	Length	Beam	Draft	Category
Very Large Gas Carrier	VLGC	80,000	754'	119'	36'	Post-Panamax
Large Gas Carrier	LGC	57,000	672'	105'	33'	Post-Panamax
Medium Gas Carrier	MGC	30,000	600'	100'	33'	Panamax
Semi-Refrigerated		20,000	525'	87'	33'	Panamax
Pressurized		7,200	391'	60'	21'	Coastal





Routing from Houston to Ensenada Single Port Call



Routing from Houston to Ensenada Multiple Port Calls (Larger Vessel)

Charter rates were established from recent ship brokerage newsletters

Average LPG Carrier Charter Rates (Aug 2012)

Vessel Size	Rate per Month
3,500 cbm	\$250,000
20,000 cbm	\$850,000
35,000 cbm	\$825,000
60,000 cbm	\$950,000
82,000 cbm	\$1,100,000

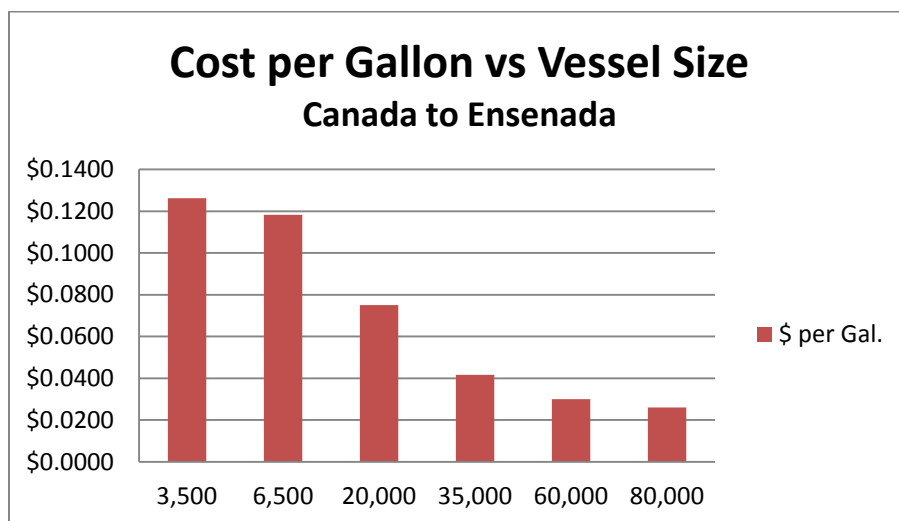
Lorentzen & Stemoco AS

Rate per Gal., 30 day round trip; Galena Park to Ensenada Zeta Terminals

Vessel Size	Gallons	Rate per Gal.
3,500 cbm	924,000	\$0.2706
20,000 cbm	5,280,000	\$0.1610
35,000 cbm	9,240,000	\$0.0893

Rate per Gal., 45 day round trip; Galena Park to 3 Zeta Terminals (including Ensenada)

Vessel Size	Gallons	Rate per Gal.
60,000 cbm	15,840,000	\$0.0899
82,000 cbm	21,648,000	\$0.0762



LPG Transportation Cost Comparisons

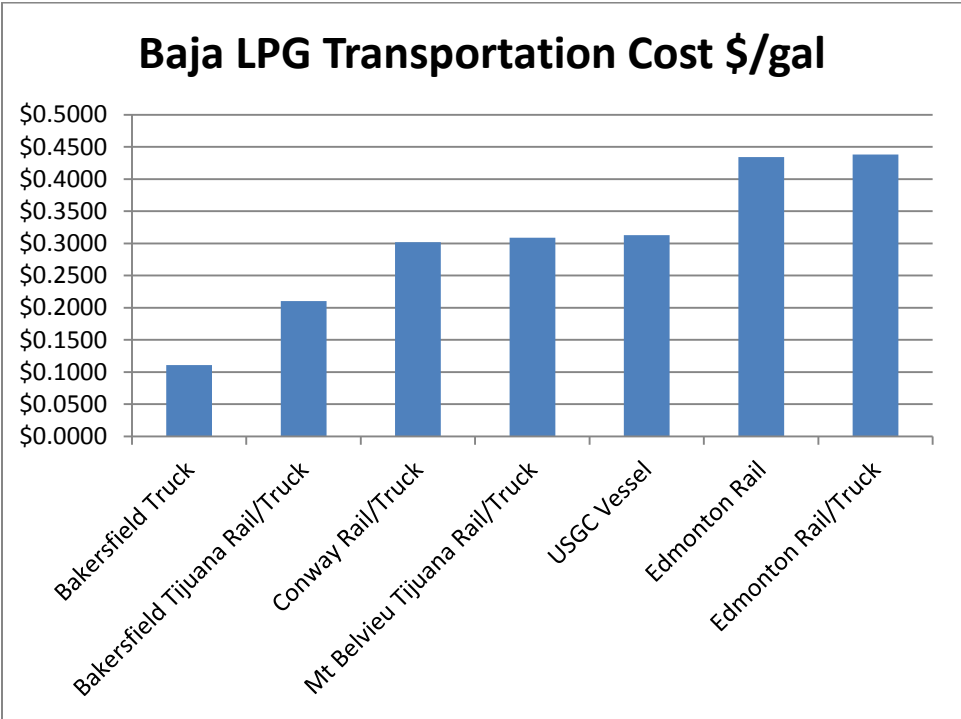
Based upon the analysis conducted above, a preliminary ranking of transportation for movement of LPG from the hubs under study to northern Baja was performed using the Excel workbook tool which accompanies this study.

Assumptions were made which are entered into the workbook tool. One of the key assumptions was the vessel sized used for the marine option. The vessel size was matched to the estimated maximum volume at Ensenada. A Medium Gas Carrier (MGC) was used for the analysis. Rail rates and fuel surcharges were obtained from railroad websites. Truck costs were estimated from a costing/rate tool.

The preliminary costs per gallon are shown on the table below:

Lane	Modes	Total
Rogas-NatCit-Rosarito	Rail, Truck	\$0.2104
Rogas-Valle Redondo-Rosarito	Rail, Truck	\$0.2319
Lone Star-NatCit-Rosarito	Rail, Truck	\$0.2107
Lone Star-Valle Redondo-Rosarito	Rail, Truck	\$0.2322
Rogas-Mexicali	Truck	\$0.1312
Lone Star - Mexicali	Truck	\$0.1312
Zuni - Mexicali - Rosarito	Rail, Truck	\$0.3068
Zuni- Nat Cit - Rosarito	Rail, Truck	\$0.2466
Zuni - Valle Redondo - Rosarito	Rail, Truck	\$0.2681
Mt Belvieu-NatCit-Rosarito	Rail, Truck	\$0.3089
Mt Belvieu-Valle Redondo-Rosarito	Rail, Truck	\$0.3305
Conway-NatCit-Rosarito	Rail, Truck	\$0.3019
Conway-Valle Redondo-Rosarito	Rail, Truck	\$0.3234
Rogas - Rosarito	Truck	\$0.1109
Lone Star - Rosarito	Truck	\$0.1109
Bumstead - NatCit- Rosarito	Rail, Truck	\$0.2478
Adamana - NatCit - Rosarito	Rail, Truck	\$0.2389
Bumstead - Valle Redond- Rosarito	Rail, Truck	\$0.2693
Adamana - Valle Redond - Rosarito	Rail, Truck	\$0.2604
Bumstead - Rosarito	Truck	\$0.2153
Adamana - Rosarito	Truck	\$0.2153
Edmonton-NatCit-Rosarito	Rail, Truck	\$0.4166
Edmonton-Val Redondo-Rosarito	Rail, Truck	\$0.4381
USGC-Ensenada-Rosarito	Vessel, Truck	\$0.3129
USGC-Ensenada-Rosarito	Vessel, Barge	\$0.3062
Edmonton-Ensenada-Rosarito	Rail, Vsl,Trk	\$0.4340
Edmonton-Ensenada-Rosarito	Rail, Vsl,Brge	\$0.3773

The key routes are ranked in the graph below:

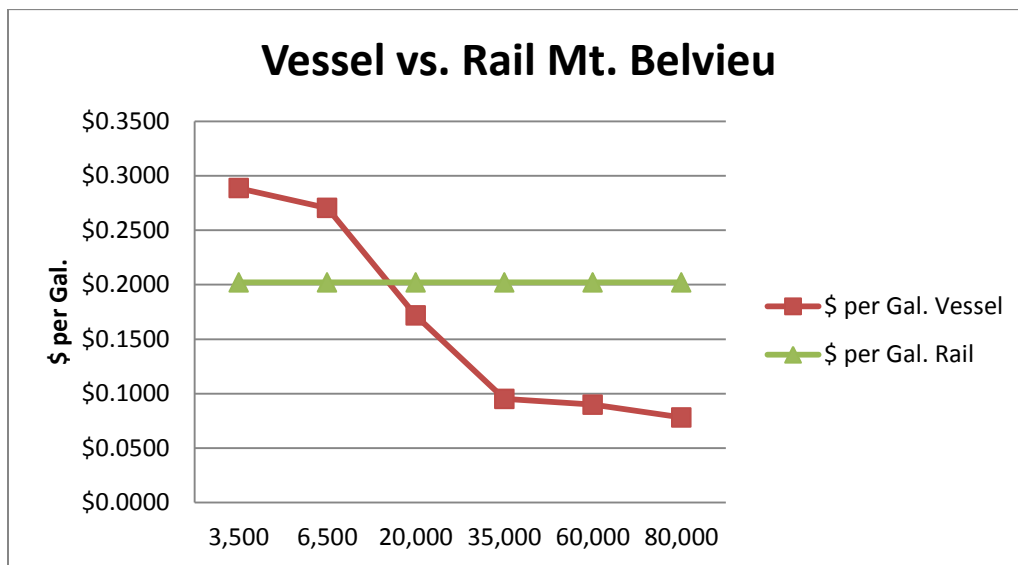


Vessel vs. Rail Cost Comparison

To compare the vessel economics with rail, it is prudent to assess the move with most likely vessel origin at Houston/Mt. Belvieu. It is assumed that the vessel would load at one of the LPG terminals on the Houston Ship Channel, while the rail would load at one of the Mt. Belvieu rail terminals. Ensenada is the chosen Baja destination marine terminal.

The largest vessel which could transit the Panama Canal prior to the expansion would be the Large Gas Carrier of approximately 30,000 CBM. This vessel size is equivalent to approximately 9 million gallons.

Due to the vessel economics discussed above, larger vessels have a lower cost per gallon. For a comparison to a Mt. Belvieu rail move, a vessel would be more expensive until a vessel size of approximately 20,000 cbm or 5,280,00 gallons.



The transit time for a vessel from Houston to Ensenada through the Panama Canal is approximately 13 days. With loading and unloading times this would average out to approximately one round trip voyage per month. In order to maintain the vessel active during the entire time charter period, the ship would be continuously in transit except for the in port periods where routine maintenance would be conducted.

Since the vessel costs require that a ship of at least 20,000 cbm be used, a volume of at least 5,280,000 gallons per month would be required to be moved through the Ensenada terminal, which would mean a minimum contract of 5 million gallons per month to the marine terminal operator.

The economics of the waterborne option require both a large vessel and a substantial contract in order to be competitive with a rail move from Mt. Belvieu. There is also a substantial loading cost of between \$0.13 to \$0.15 per gallon which can further skew the movement in favor of rail.

Scenarios Based Upon Spot Price

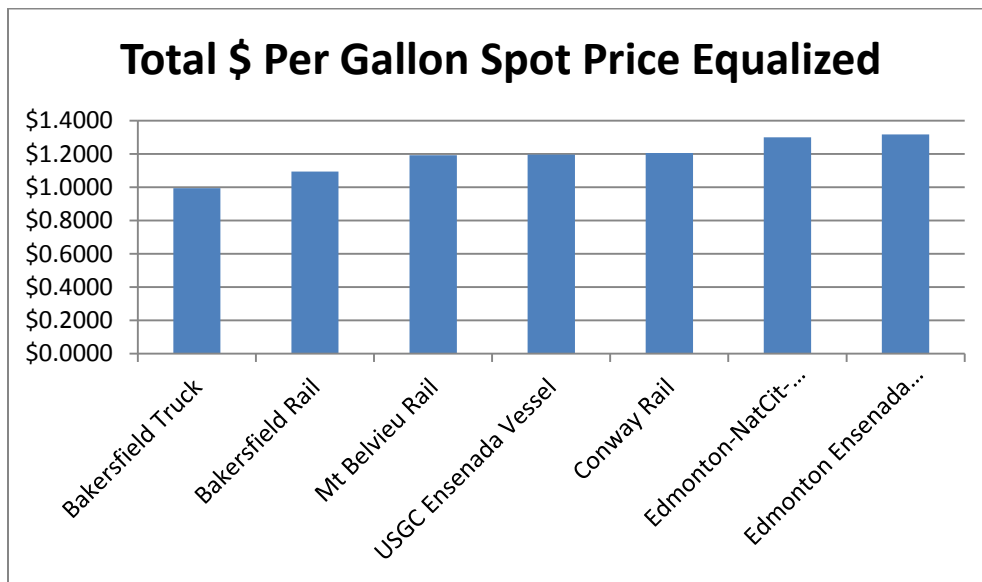
The most important element in evaluating the competitiveness of any hub in serving northern Baja is the spot price. The differentials in the spot prices more than compensate for many of the differences in transportation costs.

For general trends, Conway is minus Mt Belvieu, and Edmonton is minus Conway (transportation netbacks). Bakersfield has traditionally been Mt. Belvieu plus.

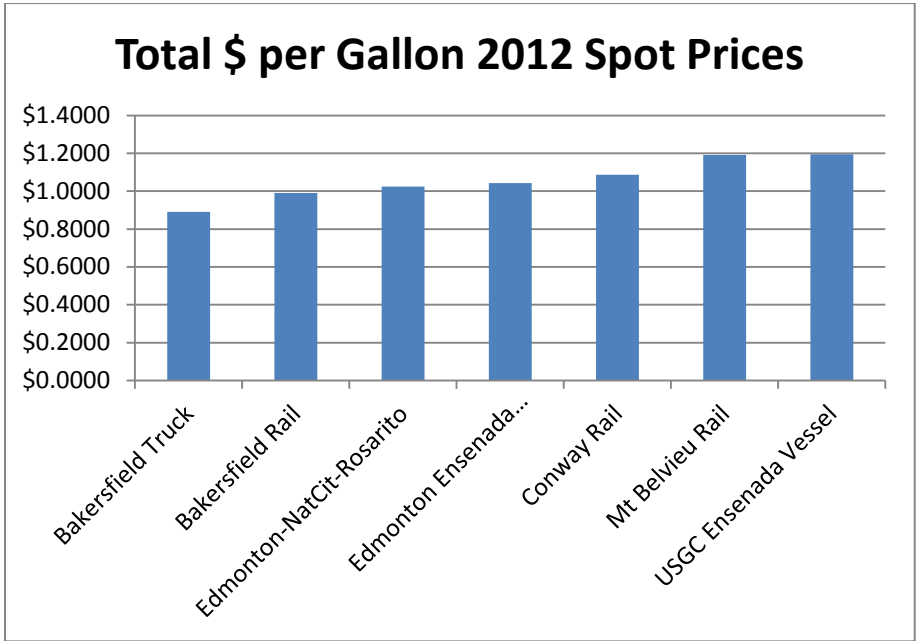
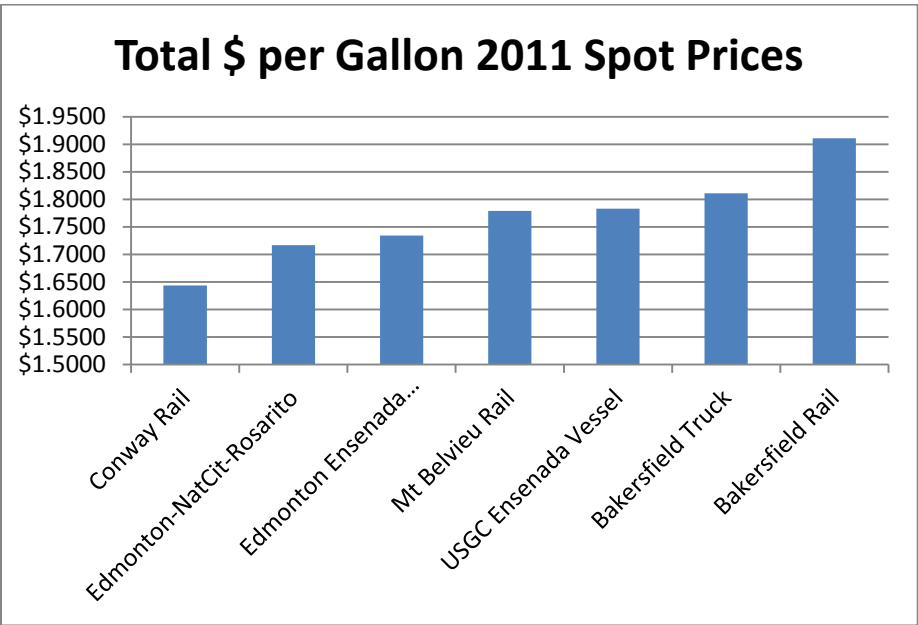
For purposes of evaluation and comparison, three scenarios we developed based upon spot price.

They are shown in the table below:

Hub	Scenario A	Scenario B	Scenario C
	Equalized	Sept 2011	Sept 2012
Mt Belvieu	Mt Belvieu	Mt Belvieu	Mt Belvieu
Conway	Mt Belvieu	Mt Belvieu -15	Mt Belvieu -12
Edmonton	Mt Belvieu	Mt Belvieu - 17	Mt Belvieu -28
Bakersfield	Mt Belvieu	Mt Belvieu + 23	Mt Belvieu -10



The table above shows total costs ranked. The spot price at all locations is equalized to be the same as Mt Belvieu. This is essentially the transportation cost differential identified earlier in this study.



A comparison of the two tables above shows that the spot price differentials have a greater impact on the delivered costs than the transportation charges. The spot price has become the key determinant in establishing any long term contract commitments.

Equalized Costs

Lane	Total \$
Bakersfield Truck	\$0.9929
Bakersfield Rail	\$1.0927
Mt Belvieu Rail	\$1.1909
USGC Ensenada Vessel	\$1.1949
Conway Rail	\$1.2054
Edmonton-NatCit-Rosarito	\$1.2986
Edmonton Ensenada Rail/Vessel	\$1.3160

2011 Baja Costs

Lane	Total \$
Conway Rail	\$1.6434
Edmonton-NatCit-Rosarito	\$1.7166
Edmonton Ensenada Rail/Vessel	\$1.7340
Mt Belvieu Rail	\$1.7789
USGC Ensenada Vessel	\$1.7829
Bakersfield Truck	\$1.8109
Bakersfield Rail	\$1.9107

2012 Baja Costs

Lane	Total \$
Bakersfield Truck	\$0.8909
Bakersfield Rail	\$0.9907
Edmonton-NatCit-Rosarito	\$1.0246
Edmonton Ensenada Rail/Vessel	\$1.0420
Conway Rail	\$1.0874
Mt Belvieu Rail	\$1.1909
USGC Ensenada Vessel	\$1.1949

Conclusions

Changes in the importation regulations for LPG in Northern Baja along with the rapid increase in North American LPG production have opened up additional opportunities to penetrate the market. Sufficient infrastructure exists in both the Mexican terminals and North American sourcing facilities to accommodate the demand in Northern Baja. Transportation costs are a major factor in determining the more competitive routes. Marine terminals and the use of larger LPG vessels can make a move by water a more competitive option, but only if there is sufficient contracted volume. There is some limitation due to marine terminal capacity but it is anticipated that this will be quickly overcome. However the spot price at the individual hub has the greatest impact on the determining the most competitive corridors. Having confidence in the future trends for these hub spot prices is essential in establishing a strategy for future long term contracts involving moving LPG into Northern Baja.

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