APPENDIX C

Supplemental Information to Market Analysis

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SUPPLEMENTAL INFORMATION TO MARKET ANALYSIS

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ACRONYMS AND ABBREVIATIONS

AB	Alberta
AL	Alabama
AR	Arkansas
bbl	barrel
BC	British Columbia
BNSF	Burlington Northern-San Francisco Railway
BP	British Petroleum
bpd	barrels per day
CA	California
CAPP	Canadian Association of Petroleum Producers
CN	Canadian National
CO	Colorado
CP	Canadian Pacific Railway
DE	Delaware
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EOG	EOG Resources, Inc.
FL	Florida
GA	Georgia
GT	GT Logistics LLC
IL	Illinois
KCS	Kansas City Southern Railway Company
KM	Kinder Morgan
KMEP	Kinder Morgan Energy Partners
LPLA	Louisiana
LLC	Limited Liability Company
L.P.	Limited Partnership
LP	Limited Partnership
LRVC	long run variable costs
MB	Manitoba
ME	Maine
MI	Michigan
MO	Missouri
MS	Mississippi
MT	Montana
na	not available
NB	New Brunswick
ND	North Dakota
NJ	New Jersey
NM	New Mexico
NS	Nova Scotia
NY	New York
OH	Ohio
OK	Oklahoma
OKDOT	Oklahoma Dept. of Transportation
OR	Oregon
PA	Pennsylvania
PADD	Petroleum Administration for Defense District
PQ	Province of Quebec, now abbreviated QC
Q	quarter
QC	Quebec
SK	Saskatchewan
STCC	Standard Transportation Commodity Code
TET	Texas Eastern Transmission Pipeline
TX	Texas
UP	Union Pacific Railroad Company
URCS	uniform rail costing system
U.S./US	United States
USA	United States of America
USDG	U.S. Development Group
UT	Utah
VA	Virginia
WA	Washington
WCSB	Western Canadian Sedimentary Basin
WRB	WRB Refining, LLC operates joint-venture WRB Refinery
WTI	West Texas Intermediate crude
WY	Wyoming
YE	year end

1.0 INTRODUCTION

This appendix supplements information related to the Market Analysis in the Supplemental Environmental Impact Statement (EIS) (Section 1.4, Market Analysis). The Supplemental EIS refers to specific section numbers in this appendix.

2.0 RELATIONSHIP OF PADD REGIONS TO U.S. CRUDE OIL MARKET

This section expands upon the discussion of U.S. Petroleum Administration for Defense District (PADD) regions by providing additional background information related to locations, characteristics, and refining and supply profiles of the PADDs and their interactions in the crude oil market. This section also includes refinery upgrading and expansion projects.

The 50 states and the District of Columbia are divided into five districts. The origin of PADDs dates from World War II when it was necessary to allocate the domestic petroleum supply. The “boundaries” between the different PADDs do not reflect either a regulatory or a business requirement; however, the boundaries allow the U.S. Energy Information Administration (EIA) a mechanism to consistently report the key attributes of the petroleum industry (inventory, crude processing levels, prices, consumption, etc.) over various time periods:

- PADD 1 (East Coast):
  - PADD 1A (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
  - PADD 1B (Central Atlantic): Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania.
  - PADD 1C (Lower Atlantic): Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia.
- PADD 2 (Midwest): Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin.
- PADD 3 (Gulf Coast): Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas.
- PADD 4 (Rocky Mountain): Colorado, Idaho, Montana, Utah, and Wyoming.
- PADD 5 (West Coast): Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington.

2.1 PADD SUPPLY CHARACTERISTICS

In general, each PADD reflects the typical supply patterns described in this section. PADD 1, the East Coast, is supplied by petroleum imports from foreign countries as well as refineries in PADD 3. Mid-Atlantic region refineries also supply PADD 1. PADD 3 refineries move product into PADD 1 via Colonial pipeline and Kinder Morgan’s Plantation pipeline, while marine movements from the Gulf Coast supply Florida. PADD 1 refineries process crude oil solely from foreign sources and in general require light, sweet, and therefore expensive crude oil relative to refiners in other U.S. PADD regions.

PADD 2 is a large region stretching from the Plains states (Oklahoma through North Dakota) and east to Ohio, Tennessee, and Kentucky. In general, PADD 2 is the Midwest district and it contains several distinct markets, with the Group and Chicago markets being subsets of PADD 2. The Group is the region of refineries, pipelines, and states from Oklahoma north to Minnesota and North Dakota. These are supplied by refiners in the Group as well as imports from PADD 3 via Magellan and Explorer pipelines. The Chicago market (northern and eastern region) also imports product from PADD 3 through the Explorer and TET[1] (Enterprise) pipeline systems. Overall, PADD 2 is far less dependent upon waterborne imports than PADD 1, as PADD 2 has significant refining capacity. PADD 2 processes significant volumes of Canadian crude.

PADD 3 is the major petroleum-refining center of the United States. Most refineries are located along the Gulf Coast (except some in the Texas Panhandle, New Mexico, and Arkansas) and process a high percentage of foreign crude, which arrives by marine vessels. Product from PADD 3 is shipped into PADD 1 and PADD 2 markets. Product not required for demands in PADDs 1 through 3 is often exported from PADD 3 to Latin America and European countries. PADD 3 has, to date, processed very limited volumes of Canadian crude.

PADD 4 is the Rocky Mountain region. This area has smaller refineries sized for relatively stable and low demand levels in this region. Refiners process both local domestic and Canadian crudes.

PADD 5 is the West Coast region. Refineries are concentrated in California and the Puget Sound region. The market is difficult to supply since it is isolated from other PADDs with no connecting pipelines, and California has unique environmental gasoline specifications that are difficult to produce and transport from other sources. Canadian crude moves primarily by pipeline into several Puget Sound refineries. Arizona, Nevada, and Oregon are supplied from California and Washington area refiners.

2.2 REFINERY CRUDE SELECTION PROCESS

Refineries perform the role of taking raw crude oil, boiling it into different fractions (naphtha, kerosene, gas oil, and residuum), and converting those fractions through additional processes (thermally heating, catalytic reactions, and cracking larger molecules into smaller ones) into blendstocks used for products such as gasoline, diesel, jet fuel, and heating oil. While most U.S. refineries have these functions, each refinery is unique in that it has different levels of processing capacity for handling all the fractions, and also has different metallurgy and treating processes that may or may not allow the refinery to run certain types of crude oils. These different "hardware" characteristics may cause one refiner to value a specific crude oil differently than another crude oil.

Each refinery has a programming model of their facility that reflects their specific capacities, limitations, and processing options (e.g., ability to maximize gasoline yield and diesel yield). These refinery configurations allow the refiner to evaluate specific crude supply options by entering the estimated crude oil cost, crude oil characteristics (percentages of naphtha, kerosene,

[1] Texas Eastern Transmission Pipeline

other distillates, or molecules in the crude oil), and the estimated and wholesale (spot) market prices for the refinery products.

Generally, refineries evaluate crude oils available to them based on their location and available crude oil supply. Refiners in PADD 1 focus on purchasing the cheapest foreign low-sulfur or sweet crudes they can, and select the crude oil that provides them the best product yield for the crude price. For example, PADD 1 refiners have been acquiring railcar supply of Bakken crude from North Dakota because, even with relatively high railcar shipping costs, Bakken crude arrives on the East Coast at a much lower price than other crude oil with similar characteristics imported from Africa.

Refiners in PADD 3 also rely heavily on foreign imports. However, many PADD 3 refiners are designed to process very heavy, cheaper crude oil than refiners in PADD 1. PADD 3 has a particularly high heavy crude oil processing capacity in part because of the proximity of large supplies of heavy crude oil in Mexico and Venezuela. In addition, Mexico and Venezuela, through their state-controlled oil companies, supported expansion of the heavy oil refining capacity through several joint-venture investments in Gulf Coast refineries to create a more profitable market for their heavy crude oil resources. Consequently, heavy, high-sulfur crude oil from Venezuela and Mexico, as well as newer heavy sources from Brazil and Colombia, are generally more optimal for these refiners to process than domestic or imported light, sweet crude.

A refiner that processes heavy crudes has invested significant amounts of money to install the equipment necessary to process them. A refiner that has made these investments has economic incentive to continue to process heavy crudes and may not be able to process significantly lighter crude slates as profitably. For example, if a refinery configured to process a heavy slate of crude oil was constrained to processing only a light crude oil slate, the volume of gasoline and diesel fuels produced could decrease by 15 to 20 percent. This, in most cases would be because the refiner's crude oil distillation process is designed for crudes with much less *light* components, such as naphtha, as heavier crudes. Attempting to process high percentages of light crude oil in these units would overload the distillation towers with light products and require a reduction in crude processing. Not only would the refiner usually be paying relatively more for that light slate of crude oil, it would be producing less gasoline and diesel from it. This is the primary reason refiners would not typically replace a heavy crude oil slate with 100 percent light crudes (IHS CERA 2011).

To go back to efficiently process more light crudes more economically, those refiners would have to make additional expenditures in refinery equipment to reconfigure the distillation towers to handle the lighter crude, and add capacity to process the higher naphtha content into finished gasoline. Thus, even if an influx of light domestic crudes makes them comparatively price advantaged to heavy crude oils, the size of capital expenditure and downed production time for refiners may offset potential benefits of trying to process more light crudes (Platts 2012).

That said, ultimately refiners will shift their crude slate if they determine that they could achieve a higher profit level by making changes to their crude runs or crude slate, including making investments to shift to a lighter crude slate. Refiners determine the optimal crudes to process like any other manufacturing company selecting the right raw materials to manufacture products. Refining companies (including refining divisions in large, integrated major oil companies) pay market prices for the crude oil they run and measure their profitability based on selling their product into the wholesale spot market with an added margin. They then use that margin to cover their fixed and variable expenses. Refiners may select a more expensive crude oil if that crude oil's yield provides a greater margin than a cheaper crude.

Finally, some refiners have more flexibility to receive different crude oils than others based on location and storage capability. Refiners in the Gulf Coast area[2] generally have the greatest access since there are marine and pipeline options to receive both foreign and domestic crude and this will increase as more pipeline expansions are completed in the next several years. Some Gulf Coast area refiners may process as many as 50 different crude oils in a given year, constantly optimizing their crude selection based on available cargoes of crude oil. Meanwhile, others tend to rely on several major suppliers such as Saudi Arabia or Mexico for the bulk of their supply.

3.0 CRUDE-BY-RAIL LOADING, OFF-LOADING, AND TRANSLOADING FACILITIES

In this section, the following tables (Table 1 through Table 11) provide specific information to supplement the narrative and figures in the Market Analysis related to crude-by-train loading, off-loading, and transloading facilities.

Table 1 PADD 1 Crude-by-Rail Offloading

Crude-by-Rail Terminal/Operator/Owner(s)	Estimated Capacity (bpd)	Estimated In-Service Date
Buckeye Partners, L.P., Albany, NY	135,000	In service (2012)
Buckeye Partners, L.P., Perth Amboy, NJ	60,000	1H2014
Carlyle Refinery/Philadelphia Energy Solutions, Philadelphia, PA	140,000	2013
CN Line, Portland, ME	na	In service
Enbridge Rail/Canopy Prospecting/ Eddystone Rail Company, Philadelphia, PA (Phase I)	80,000	2013 (late)
Enbridge Rail/Canopy Prospecting/ Eddystone Rail Company, Philadelphia, PA, (Phase 2, 160,000 bpd total)	80,000	2014 (late)
Genesis Energy, L.P., Walnut Hill, FL	75,000	2012
Global Partners LP, Albany, NY	160,000	In service
Global Partners/New Windsor Terminal, New Windsor, NY	na	na
NuStar Energy LP, Paulsboro, NJ, and Savannah, GA	24,000	2013
PBF Energy, Delaware City, DE	150,000	In service
Phillips 66, Bayway, NJ	75,000	2H 2014
Plains All American Pipeline LP, Yorktown, VA	140,000	2013
Sunoco/Eagle Point Terminal, Westville, NJ	40,000	In service
Estimated Total 2013	**944,000**	
Estimated Total 2016	**1,159,000**	

Source: Company and media reports. See Section 4.2.1, Table References.

bpd = barrels per day, DE = Delaware, FL = Florida, GA = Georgia, LLC = Limited Liability Company, L.P. = Limited Partnership, LP = Limited Partnership, ME = Maine, na = not available, NJ = New Jersey, NY = New York, PA = Pennsylvania, PADD = Petroleum Administration for Defense District, VA = Virginia.

[2] Unless otherwise specified, in this Final Supplemental Environmental Impact Statement, the Gulf Coast area includes coastal refineries from Corpus Christi, Texas, through the New Orleans, Louisiana, region.

Table 2 PADD 2 Bakken Rail Loading

Crude-by-Rail Terminal/Operator/Owner(s)	Estimated Capacity (bpd)	Estimated In-Service Date
Basin Transload , Zap, ND (Phase 1)	60,000	Operational
Crestwood/COLT, Epping, ND	120,000	2012
Dakota Gas, Beulah, ND	na	In development
Dakota Plains/Transport Solutions, New Town, ND (Phase 1)	20,000	2010
Dakota Plains/Transport Solutions, New Town, ND	10,000	2011
Dakota Plains/Transport Solutions/Pioneer Project, New Town, ND (Phase 2)	50,000	2014
Enbridge Berthold, Berthold, ND (Phase 1)	10,000	2012
Enbridge Berthold, Berthold, ND (Phase 2)	70,000	2013
Great Northern Mid-Stream, Fryburg, ND (Phase 1)	70,000	2012
Hess, Tioga, ND, (Phase 1)	55,000	2012
Hess, Tioga, ND, (Phase 2)	65,000	2014
High Sierra, Centennial and Donnybrook, ND	10,000	2008
High Sierra, Dickinson, ND (manifest)	na	Operational
High Sierra, Williston, ND (manifest)	na	Operational
Lario Logistics/Bakken Oil Express, Dickinson, ND (initial capacity) (Phase 1)	100,000	2011
Lario Logistics/Bakken Oil Express, Dickinson, ND (Phase 2)	50,000	2013
Lario Logistics/Bakken Oil Express, Dickinson, ND (Phase 3)	100,000	2016E
Mountrail, Palermo, ND	160,000	2014
Musket, Dickinson, ND	10,000	Operational
Musket, Dore, ND	60,000	2012
ND Port Services, Minot, ND	10,000	2008
North Star Transloading, Fairview, MT	100,000	2014
Plains All American/CP Van Hook, Van Hook Township, ND (Phase 1)	35,000	1Q 2012
Plains All American/CP Van Hook, Van Hook Township, ND (Phase 2)	33,000	2014
Plains All American/Ross, Manitou, ND	68,000	Operational
Red River Supply, Williston, ND (manifest)	na	Operational
Sand Source, Berthold, ND (manifest)	na	Operational
Savage, Trenton, ND	90,000	2012
Stampede, ND	80,000	Operational
Twin Eagle/Enserco, Gascoyne, ND	10,000	2013
Watco/ EOG, Stanley, ND	65,000	2009
Estimated Total 2013	**1,003,000**	
Estimated Total 2016	**1,511,000**	

Source: Company and media reports. See Section 4.2.2, Table References.

bpd = barrels per day, CP = Canadian Pacific Railway System, EOG = EOG Resources, Inc., KCS = Kansas City Southern Railway Company, MT = Montana, ND = North Dakota, PADD = Petroleum Administration for Defense District, Q = quarter.

Table 3 PADD 2 Non-Bakken Loading Facilities

Crude-by-Rail Terminal/Operator/Owner(s)	Estimated Capacity (bpd)	Estimated In-Service Date
Buckeye Partners, Woodhaven, MI (off-loading)	8,600	Operational
Canadian National, Toledo, OH	na	Operational
Chesapeake/Westhom, Thomas, OK, (Phase 1)	10,000	2013
CrossTex Energy/Ohio Oil Gathering LLC/Black Run Terminal, Frazeyburg, OH	24,000	2012
Logimarq Transloading/Marquis Energy Trading, Sayre, OK	30,000	2011
MarkWest Energy, Cadiz, OH	na	In development
Mercuria Energy Trading, Okeene, OK	na	2012
Oklahoma Dept. of Transportation), Farmrail, Sayre, OK	28,000	2013
Savage, Ohio Commerce Center, Lordstown, OH	60,000	2013
Sovereign Development, Ardmore, OK	40,000	In development
Watco, Midwest City, OK (manifest)	na	Existing
W.B. Johnston, Enid, OK (manifest)	na	Existing
W.B. Johnston, Shattuck, OK (manifest)	na	Existing
Estimated Total 2013	**160,600**	
Estimated Total 2016	**200,600**	

Source: Company and media reports. See Section 4.2.3, Table References.

bpd = barrels per day, CN = Canadian National Railway, LLC = Limited Liability Company, na = not available, MI = Michigan, OH = Ohio, OK = Oklahoma, OKDOT = Oklahoma Dept. of Transportation, PADD = Petroleum Administration for Defense District, W.B. = Willis Boyd Johnston, Johnston Enterprises, Inc.

Table 4 PADD 2 Stroud to Cushing Loading/Transloading/Offloading Facilities

Crude-by-Rail Terminal/Operator/Owner(s)	Estimated Capacity (bpd)	Estimated In-Service Date
EOG, Stroud OK to Cushing, OK	90,000	2009
Watco/KMEP I Dore, Stroud, OK, to and from Cushing (Phase 1)	60,000	2011
Estimated Total 2013	**150,000**	
Estimated Total 2016	**150,000**	

Source: Company and media reports. See Section 4.2.4, Table References.

bpd = barrels per day, EOG = EOG Resources, Inc., KMEP = Kinder Morgan Energy Partners LP, OK = Oklahoma, PADD = Petroleum Administration for Defense District.

Table 5 PADD 2 Rail to Marine Transloading Facilities

Crude-by-Rail Owners/Operators/Venture Partners	Estimated Capacity (bpd)	Estimated In-Service Date
Basin Transload, Cape Giradeau, MO	40,000	In development
Cogent, Lockport, IL	40,000	In development
Hoffman Transportation, Lorenzo, IL (manifest)	na	Existing
Indigo Resources Ltd./BNSF, Osceola, AR	120,000	2014
Marquis Energy/BNSF, Hayti, MO	75,000	2012
Marquis Energy/BNSF, Hayti, MO	70,000	2013

Crude-by-Rail Owners/Operators/Venture Partners	Estimated Capacity (bpd)	Estimated In-Service Date
MV Purchasing, Lorenzo, IL (manifest)	na	Existing
Omega Partners, Hartford, IL	40,000	In development
Seacor Holdings/Gateway Terminals, Sauget, IL	65,000	2011
Estimated Total 2013	**210,000**	
Estimated Total 2016	**450,000**	

Source: Company and media reports. See Section 4.2.5, Table References.

bpd = barrels per day, AR = Arkansas, BNSF = Burlington Northern Santa Fe Railway, IL = Illinois, MO = Missouri, na = not available, PADD = Petroleum Administration for Defense District.

Table 6 PADD 3 Rail Offloading Facilities

	Estimated Capacity (bpd)	Estimated In-Service Date
Gulf Coast Area Destination Facilities		
Alon USA, Krotz Springs, LA	9,000	2013
Arc Terminals LP/Chickasaw Terminal, Chickasaw, AL	na	Operational
Arc Terminals LP, Mobile, AL	70,000	YE 2013
Arc Terminals LP, Saraland, AL	75,000	2013
BioFuels Development International/Channel Biorefinery & Terminals, Houston, TX	na	na
Bulk Resources/Murex/SGS Petroleum Services, Port of New Orleans, LA	70,000	2013
Canal Refining, Lacassine, LA	5,000	Operational
Citgo, Lake Charles, LA	20,000	Operational
Crosstex Energy/Riverside Facility, Geismar, LA (Phase 1)	4,500	2012
Crosstex Energy/Riverside Facility, Geismar, LA (Phase 2)	10,500	2013
Delek U.S. Holdings Inc., El Dorado, AR	45,000	2013
Genesis Energy/Maryland Terminal, Baton Rouge, LA	65,000	2Q 2014
Genesis Energy, Natchez, MS (Phase 1)	20,000	2013
Genesis Energy, Natchez, MS (Phase 2)	30,000	Early 2014
Genesis Energy, Raceland, LA	120,000	3Q 2014
GT Logistics/GT Omni Port, Port Arthur, TX	100,000	2012
International Matex Tank Terminals (IMTT), St. Rose, LA	na	Operational
Jefferson Refinery LLC/Orange County Terminal, Beaumont, TX (initial phase)	60,000	YE 2014
Jefferson Refinery LLC/Orange County Terminal, Beaumont, TX (additional capacity)	240,000	2016
JW Stone Oil Distributors, Port Manchac, LA	15,000	2013
Kansas City Southern, Port Arthur, TX (design capacity up to 5 unit trains)	na	Potential
KW Express/Mercuria Energy, Houston, TX	210,000	2014
LBC Tank Terminals, Geismar, LA	na	Operational
Magellan Midstream Partners, Galena Park, TX	na	na
NuStar/EOG, St. James, LA	70,000	2012
NuStar/EOG, St. James, LA	70,000	2013

	Estimated Capacity (bpd)	Estimated In-Service Date
Petroplex International LLC, St. James, LA	70,000	2015
Plains All American, St. James, LA (Phase 1)	65,000	2011
Plains All American, St. James, LA (Phase 2)	75,000	2012
Sunoco, Nederland, TX	15,000	2012
Texas International Terminals, Galveston, TX	60,000	Operational
Trafigura, Corpus Christi, TX	30,000	2012
Transmontaigne, Brownsville, TX	40,000	Operational
Valero/St. Charles Refinery, Norco, LA	20,000	2013
Valero/St. Charles Refinery, Norco, LA	10,000	2014
Watco Greens/Port Industrial Park, Houston, TX	65,000	2011
Wolverine Terminals/Paulina Terminal, St. James, LA	10,000	2014
Estimated Total 2013	**984,000**	
Estimated Total 2016	**1,769,000**	

Source: Company and media reports. See Section 4.2.6, Table References.

bpd = barrels per day, AL = Alabama, AR = Arkansas, BNSF = Burlington Northern Santa Fe Railway, CN = Canadian National Railway, EOG = EOG Resources, Inc., GT = GT Logistics LLC, JW Stone = John W. Stone Oil Distributor L.L.C., KW Express = Kinder-Morgan and Watco partnership, LA = Louisiana, LLC = Limited Liability Company, LP = Limited Partnership, MS = Mississippi, na = not available, Q = quarter, PADD = Petroleum Administration for Defense District, TX = Texas, UP = Union Pacific, U.S. = United States, USA = United States of America, YE = year end.

Table 7 PADD 3 Crude-by-Rail Loading Terminals

	Estimated Capacity (bpd)	Estimated In-Service Date
Atlas Oil Company, Albuquerque, NM	na	2009
Atlas Oil Company, La Feria, TX	na	Operational
Atlas Oil Company, Monahans, TX	na	2013
Atlas Oil Company, Odessa, TX (Phase 1)	1,000	Operational
Atlas Oil Company, Odessa, TX (Phase 2)	3,000	2014
Cetane Energy/Murex N.A., Ltd., Carlsbad, NM	70,000	2012
Crosstex/UP, Mesquite, TX (NGL and crude)	na	Operational
East Kelly Railport, Port San Antonio, TX	30,000	Operational
Enbridge, Kings Mill, TX (manifest)	na	Operational
EOG/TX Pacifico Railroad/UP, Barnhart, TX	45,000	Operational
EOG, San Angelo, TX	5,000	2012
EOG Resources, Harwood, TX	45,000	2012
Frontier Logistics/Frac Resources/UP/Mission Rail Park, Elmendorf, TX	25,000	2013
Genesis Energy/UP TX/NM Railroad, Wink, TX	75,000	2013
Holly Energy Partners, Lovington, NM	70,000	2014
Howard Energy/Crosstex/UP, Live Oak, TX	60,000	2013
Iowa Pacific Holdings LLC/LogiBio LLC, Lovington, NM	60,000	2013
Martin Midstream/KMEP/ Pecos Valley Producer, Pecos, TX, Permian	60,000	2012
Martin Midstream/KMEP/ Pecos Valley Producer, Pecos, TX, Permian	205,000	2013
Mercuria Energy Trading, Borger, TX, Permian	na	Operational

	Estimated Capacity (bpd)	Estimated In-Service Date
Mercuria Energy Trading, Brownfield, TX	8,000	2013
Mercuria Energy Trading, Seagraves, TX (unit train)	na	In development
Murex/ Hondo Rail Co./BNSF, Hondo, TX	25,000	Operational
Navajo Nation/Thoreau Industrial Park, Thoreau, TX	60,000	2014
Plains All American/Eagle Ford Crude Terminal, Cotulla (Gardendale), TX	40,000	2011
Rangeland Energy/BNSF Railways, Loving, NM	60,000	2013
Estimated Total 2013	**814,000**	
Estimated Total 2016	**947,000**	

Source: Company and media reports. See Section 4.2.7, Table References.

bpd = barrels per day, BNSF = Burlington Northern Santa Fe Railway, EOG = EOG Resources, Inc., KMEP = Kinder Morgan Energy Partners LP, LLC = Limited Liability Company, Ltd. = Limited, MS = Mississippi, N.A. = North America, na = not available, NGL = natural gas liquids, NM = New Mexico, PADD = Petroleum Administration for Defense District, TX = Texas, UP = Union Pacific, USA = United States of America.

Table 8 PADD 4 Rail Loading Facilities

Crude-by-Rail Terminal	Estimated Capacity (bpd)	Estimated In-Service Date
BNSF/Hudson Terminal Railroad, Hudson, CO	6,000	Operational
Crescent Point/Uinta Basin, Northeast, UT	10,000	2013
Eighty-Eight Oil/BNSF, Ft. Laramie, WY	80,000	2013
Enserco Midstream, LLC/BNSF, Douglas, WY	60,000	2013
Enserco Midstream, LLC/BNSF, Douglas, WY	60,000	2014
Granite Peak Development/Cogent Energy Solutions, Casper, WY	160,000	2014
Meritage Midstream, Black Thunder, WY	10,000	2013
Musket/Broe Group/Great Western Industrial Park, Windsor, CO	15,000	2012
Musket/Broe Group/Great Western Industrial Park, Windsor, CO	15,000	2013
Plains All American, Carr, CO	15,000	Operational
Plains All American, Carr, CO (Phase 2)	20,000	2014
Plains All American, Tampa, CO	68,000	2013
Savage/ Union Pacific, Price and Salt Lake City, UT	9,000	2013
Tiger Transfer, Upton, WY	40,000	Operational
Watco/Swan Ranch Railroad, Cheyenne, WY	70,000	2013
Estimated Total 2013	**398,000**	
Estimated Total 2016	**638,000**	

Source: Company and media reports. See Section 4.2.8, Table References.

bpd = barrels per day, BNSF = Burlington Northern Santa Fe Railway, CO = Colorado, LLC = Limited Liability Company, PADD = Petroleum Administration for Defense District, UT = Utah, WY= Wyoming.

Table 9 PADD 5 Rail Offloading/Transloading Facilities

Crude-by-Rail Terminal/Operator/Owner(s)		Estimated Capacity (bpd)	Estimated In-Service Date
Alon USA, Bakersfield, CA		140,000	2014
Alon USA, Long Beach, CA		10,000	2013 (planned)
Alon USA/Willbridge Refinery, Portland, OR		10,000	2013 (planned)
BP/Cherry Point Refinery, Blaine, WA		60,000	2014
Global Partners, Clatskanie, OR		60,000	2012
Kern Oil/BNSF, Bakersfield, CA		40,000	Operational
Kinder Morgan/BNSF, Richmond, CA		60,000	In development
NuStar, Vancouver, WA		3,000	2013
Phillips 66, Ferndale, WA		30,000	2H 2014
Plains All American, Bakersfield, CA (permitted for 1 unit train per day)		70,000	2014
Plains All American, Bakersfield, CA (seeking permits for additional capacity)		70,000	2014
Shell/Rail East Gate, Anacortes, WA		65,000	Planned
Targa Terminals, Port of Stockton, CA		65,000	2014
Tesoro, Anacortes, WA		40,000	2012
Tesoro/Golden Eagle Plant, Martinez, CA		5,000	in service
Tesoro/Savage, Port of Vancouver, WA (Rail to barge)		120,000	2014 (planned)
USDG/Westway/Imperium, Grays Harbor, WA (3 facilities)		90,000	2014
U.S. Oil and Refining, Tacoma, WA		40,000	2013
Valero, Union Pacific Line, Benicia, CA		70,000	2015 (planned)
Valero, Wilmington, CA		60,000	2015
WesPac Energy/Pittsburg LLC, Pittsburg, CA		65,000	2014
	Estimated Total 2013	**208,000**	
	Estimated Total 2016	**1,173,000**	

Source: Company and media reports. See Section 4.2.9, Table References.

bpd = barrels per day, BP = British Petroleum, CA = California, LLC = Limited Liability Company, OR = Oregon, PADD = Petroleum Administration for Defense District, U.S. = United States, USA = United States of America, USDG = U.S. Development Group, WA = Washington.

Table 10 Canadian Rail Loading Facilities

Facility/Owner Operator	Capacity (bpd)	In-Service Date	WCSB or Canadian Bakken[a]
Altex Energy, Falher (Peace River), AB	20,000	2013	WCSB
Altex Energy, Lashburn, SK	30,000	Operational	WCSB
Altex Energy, Lashburn, SK (expansion)	30,000	2013	WCSB
Altex Energy, Lloydminster, SK	3,000	Operational	WCSB
Altex Energy, Lynton, AB (expansion)	8,000	2013	WCSB
Altex Energy, Lynton, AB	12,000	Operational	WCSB
Altex Energy, Peace River, AB	na	Potential	WCSB
Altex Energy, Reno, AB	22,000	2014	WCSB
Altex Energy, Reno, AB	38,000	Under development	WCSB
Altex Energy, Unity, SK	19,000	Operational	WCSB

Facility/Owner Operator	Capacity (bpd)	In-Service Date	WCSB or Canadian Bakken[a]
Altex Energy, Wainwright, AB	6,000	2013	WCSB
Arrow Reload Systems, Kerrobert, SK	6,000	Operational	WCSB
Canexus Corp, Bruderheim, AB	30,000	Operational	WCSB
Canexus Corp, Bruderheim, AB (Phase 1)	30,000	2013	WCSB
Canexus Corp, Bruderheim, AB (Phase 2)	60,000	2014	WCSB
Ceres Global Ag. Corp, Northgate, SK	70,000	2013	Canadian Bakken
CN, Barr, AB	8,000[b]	Operational	WCSB
CN, Eckville, AB	na	Under development	WCSB
CN, Edson, AB	6,000	Operational	WCSB
CN, High Level, AB	3,000[b]	Operational	WCSB
CN, Lynton, AB	8,000[b]	Operational	WCSB
CN/PetroGas, Wilmar, SK	14,000	Operational	Canadian Bakken
CN, Scotford, AB	8,000[b]	Operational	WCSB
CN/Watco, Bienfait, SK	8000[b]	Operational	Canadian Bakken
CN/Watco, Woodnorth, SK	8,000[b]	Operational	Canadian Bakken
CP, Calmar, AB	na		WCSB
CP, Estevan, SK	10,000	Operation	Canadian Bakken
CP, Lambton Park, AB	na	Operational	WCSB
Crescent Point, Alliance, AB	3,000	Operational	WCSB
Crescent Point, Dollard, SK	12,000	Operational	WCSB
Crescent Point, Stoughton, SK	45,000	Operational	Canadian Bakken
Elbow River, Nampa, AB	na	Potential	WCSB
Elbow River/Roma, Peace River, AB	10,000	Operational	WCSB
Gibson, East Edmonton, AB	8,000[b]	Operational	WCSB
Gibson Energy, Edmonton, AB	20,000	2015	WCSB
Gibson Energy, Rimbey, AB	na	2013	WCSB
Gibson Energy, Sexsmith, AB	6,000	Operational	WCSB
Gibson Energy, U.S. Dev., Hardisty, AB	140,000	2014	WCSB
Grizzly Oil Sands, Windell, AB	na	Under development	WCSB
Keyera/Enbridge, South Cheecham, Wood Buffalo, AB	32,000	2013	WCSB
KM/Keyera, Edmonton, AB (initial phase)	40,000	2014	WCSB
KM/Keyera, Edmonton, AB (potential expansion)	125,000	Potential	WCSB
Pembina Pipeline, Edmonton, AB	40,000	2013	WCSB
Plains Midstream, Mitsue, AB	30,000	2015	WCSB
Predator Oil, Alliance, AB	8,000[b]	Operational	WCSB
Predator Oil, Mannville, AB	8,000[b]	Operational	WCSB
Private Owner, Kindersley	na	Operational	WCSB
Savage Services, Peace River, AB	na	Under development	WCSB
Torq Transloading, Bromhead, Southall, SK	13,000	Operational	Canadian Bakken
Torq Transloading, Instow, SK	15,000	Operational	WCSB
Torq Transloading, Kerrobert	140,000	2014	WCSB
Torq Transloading, Lloydminster, SK	10,000	Operational	WCSB
Torq Transloading, Tilley, AB	8,000	Operational	WCSB
Torq Transloading, Unity, SK	20,000	Operational	WCSB

Facility/Owner Operator	Capacity (bpd)	In-Service Date	WCSB or Canadian Bakken[a]
Torq Transloading, Unity, SK	50,000	2013	WCSB
Torq Transloading, Whitecourt, AB	3,500	Operational	WCSB
Tundra Energy, Cromer, MB (Phase 1)	30,000	2013	Canadian Bakken
Tundra Energy, Cromer, MB (Phase 2)	30,000	2014	Canadian Bakken
Unknown Operator, Mitsue, AB	8,000[b]	Operational	WCSB
Potential Project Totals			
	WCSB	**Canadian Bakken**	**Total**
2013 Estimated Capacity	**468,500**	**198,000**	**666,500**
2014 Estimated Capacity	**870,500**	**228,000**	**1,098,500**
Announced Potential Projects	**1,083,500**	**228,000**	**1,311,500**

Source: Company and media reports. See Section 4.2.10, Table References.

[a] WCSB is used to refer to the primarily heavy crude loading areas. Canadian Bakken is used to refer to primarily light crude loading areas.

[b] These facilities are listed on Canadian National Railway presentations, but capacities could not be confirmed. Estimated capacity of 8,000 bpd is based on the average capacity of other manifest facilities (with capacities of less than 20,000 bpd), except for High Level, which is assumed to be 3,000 bpd because it is not in a large production region (this is the lowest capacity of any of the crude-by-rail facilities).

AB = Alberta, BNSF = Burlington Northern Santa Fe Railway, bpd = barrels per day, CN = Canadian National Railway, CP = Canadian Pacific Railway, KM = Kinder Morgan, MB = Manitoba, na = not available, SK = Saskatchewan, US = United States, WCSB = Western Canadian Sedimentary Basin.

Table 11 Canadian Rail Offloading Facilities

Crude-by-Rail Terminal/Operator/Owner(s)	Estimated Capacity (bpd)	Estimated In-Service Date
Chevron, Burnaby, BC	7,000	Operational
Irving Refinery, St. John, NB	145,000	In service
NuStar, Point Tupper, NS	10,000	Potential
Suncor, Montreal, QC	15,000	2013 (Q4)
Valero/Jean Gauin Refinery, Levis, QC	50,000	2013
Estimated Total 2013	**227,000**	

Source: Company and media reports. See Section 4.2.11, Table References.

bpd = barrels per day, BC = British Columbia, CN = Canadian National Railway, na = not available, NB = New Brunswick, NS = Nova Scotia, Q = quarter, QC = Quebec.

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ATTACHMENTS

ATTACHMENT 1, TABLES

Table C1 Estimated Rail Costs for Various Origination and Destination Pairs

								Estimated Cost Per Barrel						
Note	Origin City	Orig ST	Dest. City	Dest. ST	Product	Miles	Total Cycle Days	Prep to Loading	Railcar Loading	Rail Freight	Railcar	Unloading	Movement to Refinery	Total
	Fort McMurray	AB	Reybold	DE	Dilbit	2779.3	14.5		$1.50	$14.60	$0.96	$1.50		$18.56
	Fort McMurray	AB	Reybold	DE	Railbit	2779.3	16		$1.75	$16.11	$1.15	$1.75		$20.76
	Fort McMurray	AB	Reybold	DE	Bitumen	2779.3	16		$1.75	$16.77	$1.20	$1.75		$21.47
	Fort McMurray	AB	Port Arthur	TX	Dilbit	3008.8	15.5		$1.50	$14.88	$1.02	$1.50	$0.52	$19.43
	Fort McMurray	AB	Port Arthur	TX	Railbit	3008.8	17		$1.75	$16.39	$1.22	$1.75	$0.57	$21.68
	Fort McMurray	AB	Port Arthur	TX	Bitumen	3008.8	17		$1.75	$17.07	$1.28	$1.75	$0.60	$22.44
	Fort McMurray	AB	Vancouver	WA	Dilbit	1367.3	9.5		$1.50	$6.91	$0.63	$1.50	$5.42	$15.96
	Fort McMurray	AB	Vancouver	WA	Railbit	1367.3	11		$1.75	$7.59	$0.79	$1.75	NA: Heat	$11.88
	Fort McMurray	AB	Vancouver	WA	Bitumen	1367.3	11		$1.75	$7.90	$0.83	$1.75	NA: Heat	$12.23
	Fort McMurray	AB	Los Angeles	CA	Dilbit	2641.9	13.5		$1.50	$13.55	$0.89	$1.50		$17.45
	Fort McMurray	AB	Los Angeles	CA	Railbit	2641.9	15		$1.75	$14.89	$1.08	$1.75		$19.47
	Fort McMurray	AB	Los Angeles	CA	Bitumen	2641.9	15		$1.75	$15.51	$1.13	$1.75		$20.13
	Fort McMurray	AB	Amoco	VA	Dilbit	2905.3	15.5		$1.50	$16.55	$1.02	$1.50		$20.58
	Fort McMurray	AB	Amoco	VA	Railbit	2905.3	17		$1.75	$18.17	$1.22	$1.75		$22.90
	Fort McMurray	AB	Amoco	VA	Bitumen	2905.3	17		$1.75	$18.92	$1.28	$1.75		$23.70
	Fort McMurray	AB	Bakersfield	CA	Dilbit	2361.3	12.5		$1.50	$12.76	$0.83	$1.50	$1.50	$18.08
	Fort McMurray	AB	Bakersfield	CA	Railbit	2361.3	14		$1.75	$13.80	$1.01	$1.75	$1.50	$19.80
	Fort McMurray	AB	Bakersfield	CA	Bitumen	2361.3	14		$1.75	$14.37	$1.05	$1.75	$1.50	$20.42
	Fort McMurray	AB	St John	NB	Dilbit	3265.7	15.5		$1.50	$15.59	$1.02	$1.50		$19.62
	Fort McMurray	AB	St John	NB	Railbit	3265.7	17		$1.75	$17.11	$1.22	$1.75		$21.84
	Fort McMurray	AB	St John	NB	Bitumen	3265.7	17		$1.75	$17.82	$1.28	$1.75		$22.60
	Fort McMurray	AB	Kitimat	BC	Dilbit	1197.2	8.5		$1.50	$5.82	$0.56	$1.50		$9.38
	Fort McMurray	AB	Kitimat	BC	Railbit	1197.2	10		$1.75	$6.39	$0.72	$1.75		$10.61
	Fort McMurray	AB	Kitimat	BC	Bitumen	1197.2	10		$1.75	$6.65	$0.75	$1.75		$10.90
	Fort McMurray	AB	Benecia	CA	Dilbit	2071.6	11.5		$1.50	$9.48	$0.76	$1.50		$13.24
	Fort McMurray	AB	Benecia	CA	Railbit	2071.6	13		$1.75	$10.43	$0.94	$1.75		$14.86
	Fort McMurray	AB	Benecia	CA	Bitumen	2071.6	13		$1.75	$10.86	$0.98	$1.75		$15.33
	Fort McMurray	AB	Vancouver	BC	Dilbit	1060.2	7.5		$1.50	$5.17	$0.50	$1.50		$8.67

Note	Origin City	Orig ST	Dest. City	Dest. ST	Product	Miles	Total Cycle Days	Estimated Cost Per Barrel: Prep to Loading	Railcar Loading	Rail Freight	Railcar	Unloading	Movement to Refinery	Total
	Fort McMurray	AB	Vancouver	BC	Railbit	1060.2	9		$1.75	$5.68	$0.65	$1.75		$9.82
	Fort McMurray	AB	Vancouver	BC	Bitumen	1060.2	9		$1.75	$5.91	$0.68	$1.75		$10.09
	Lloydminster	SK	Reybold	DE	Dilbit	2401.4	13.5		$1.50	$11.66	$0.89	$1.50		$15.55
	Lloydminster	SK	Reybold	DE	Railbit	2401.4	15		$1.75	$12.83	$1.08	$1.75		$17.41
	Lloydminster	SK	Reybold	DE	Bitumen	2401.4	15		$1.75	$13.36	$1.13	$1.75		$17.98
	Lloydminster	SK	Port Arthur	TX	Dilbit	2484.9	13.5		$1.50	$10.88	$0.89	$1.50	$0.52	$15.29
	Lloydminster	SK	Port Arthur	TX	Railbit	2484.9	15		$1.75	$11.95	$1.08	$1.75	$0.57	$17.10
	Lloydminster	SK	Port Arthur	TX	Bitumen	2484.9	15		$1.75	$12.44	$1.13	$1.75	$0.60	$17.67
	Lloydminster	SK	Vancouver	WA	Dilbit	1389.1	9.5		$1.50	$6.98	$0.63	$1.50	$5.42	$16.03
	Lloydminster	SK	Vancouver	WA	Railbit	1389.1	11		$1.75	$7.66	$0.79	$1.75	NA: Heat	$11.96
	Lloydminster	SK	Vancouver	WA	Bitumen	1389.1	11		$1.75	$7.98	$0.83	$1.75	NA: Heat	$12.30
	Lloydminster	SK	Los Angeles	CA	Dilbit	2448.6	13.5		$1.50	$12.04	$0.89	$1.50		$15.93
	Lloydminster	SK	Los Angeles	CA	Railbit	2448.6	15		$1.75	$13.22	$1.08	$1.75		$17.80
	Lloydminster	SK	Los Angeles	CA	Bitumen	2448.6	15		$1.75	$13.77	$1.13	$1.75		$18.39
	Lloydminster	SK	Amoco	VA	Dilbit	2527.6	13.5		$1.50	$14.37	$0.89	$1.50		$18.26
	Lloydminster	SK	Amoco	VA	Railbit	2527.6	15		$1.75	$15.77	$1.08	$1.75		$20.35
	Lloydminster	SK	Amoco	VA	Bitumen	2527.6	15		$1.75	$16.42	$1.13	$1.75		$21.05
	Lloydminster	SK	Bakersfield	CA	Dilbit	2281.9	12.5		$1.50	$10.24	$0.83	$1.50	$1.50	$15.57
	Lloydminster	SK	Bakersfield	CA	Railbit	2281.9	14		$1.75	$11.26	$1.01	$1.75	$1.50	$17.27
	Lloydminster	SK	Bakersfield	CA	Bitumen	2281.9	14		$1.75	$11.73	$1.05	$1.75	$1.50	$17.78
	Lloydminster	SK	St John	NB	Dilbit	2553.2	13.5		$1.50	$12.43	$0.89	$1.50		$16.32
	Lloydminster	SK	St John	NB	Railbit	2553.2	15		$1.75	$13.62	$1.08	$1.75		$18.21
	Lloydminster	SK	St John	NB	Bitumen	2553.2	15		$1.75	$14.19	$1.13	$1.75		$18.81
	Lloydminster	SK	Kitimat	BC	Dilbit	1068.9	7.5		$1.50	$5.21	$0.50	$1.50		$8.71
	Lloydminster	SK	Kitimat	BC	Railbit	1068.9	9		$1.75	$5.72	$0.65	$1.75		$9.87
	Lloydminster	SK	Kitimat	BC	Bitumen	1068.9	9		$1.75	$5.96	$0.68	$1.75		$10.13
	Lloydminster	SK	Benicia	CA	Dilbit	2062.4	12.5		$1.50	$9.35	$0.73	$1.50		$13.08
	Lloydminster	SK	Benicia	CA	Railbit	2062.4	12.5		$1.75	$10.27	$0.73	$1.75		$14.50
	Lloydminster	SK	Benicia	CA	Bitumen	2062.4	9.5		$1.75	$10.70	$0.55	$1.75		$14.75
	Lloydminster	SK	Vancouver	BC	Dilbit	1130	13.5		$1.50	$5.50	$0.79	$1.50		$9.29

								Estimated Cost Per Barrel						
Note	Origin City	Orig ST	Dest. City	Dest. ST	Product	Miles	Total Cycle Days	Prep to Loading	Railcar Loading	Rail Freight	Railcar	Unloading	Movement to Refinery	Total
	Lloydminster	SK	Vancouver	BC	Railbit	1130	12.5		$1.75	$6.03	$0.73	$1.75		$10.26
	Lloydminster	SK	Vancouver	BC	Bitumen	1130	12.5		$1.75	$6.27	$0.73	$1.75		$10.50
	Epping	ND	Reybold	DE	Bakken	1880.3	12.5		$1.50	$8.54	$0.73	$1.50		$12.27
	Epping	ND	Port Arthur	TX	Bakken	1915.7	12.5		$1.50	$7.58	$0.73	$1.50	$0.52	$11.83
	Epping	ND	Vancouver	WA	Bakken	1196.5	9.5		$1.50	$4.81	$0.55	$1.50	$3.64	$12.00
	Epping	ND	Los Angeles	CA	Bakken	2280.3	13.5		$1.50	$9.07	$0.79	$1.50		$12.86
	Epping	ND	Amoco	VA	Bakken	2006.6	12.5		$1.50	$8.89	$0.73	$1.50		$12.62
	Epping	ND	Bakersfield	CA	Bakken	1999.7	12.5		$1.50	$7.99	$0.73	$1.50	$1.50	$13.22
	Epping	ND	St John	NB	Bakken	2351.4	14.5		$1.50	$10.17	$0.85	$1.50		$14.02
	Epping	ND	Kitimat	BC	Bakken	2278.4	14.5		$1.50	$10.88	$0.85	$1.50		$14.73
1	Lynton	AB	Natchez	MS	Railbit	2786.5	17		$1.75	$16.82	$1.22	$1.75		$21.55
	Lynton	AB	Natchez	MS	Railbit	2786.5	16		$1.75	$15.06	$1.15	$1.75		$19.71
2	Reybold	DE	Fort McMurray	AB	Diluent	2779.3	2		$1.50	$8.36	$0.12	$1.50		$11.48
2	Port Arthur	TX	Fort McMurray	AB	Diluent	3008.8	2	$0.52	$1.50	$8.48	$0.12	$1.50		$12.11
2	Port Arthur	TX	Lloydminster	SK	Diluent	2487.9	2		$1.50	$6.11	$0.12	$1.50		$9.23
2	Vancouver	WA	Fort McMurray	AB	Diluent	1367.3	2	$2.56	$1.50	$4.17	$0.12	$1.50		$9.84
2	Los Angeles	CA	Fort McMurray	AB	Diluent	2641.9	2		$1.50	$6.98	$0.12	$1.50		$10.09
2	Amoco	VA	Fort McMurray	AB	Diluent	2905.3	2		$1.50	$8.24	$0.12	$1.50		$11.35
2	Bakersfield	CA	Fort McMurray	AB	Diluent	2361.3	2		$1.50	$6.29	$0.12	$1.50		$9.40
2	Natchez	MS	Lynton	AB	Diluent	2786.5	2	$0.52	$1.50	$9.98	$0.12	$1.50		$13.61
2	Natchez	MS	Lynton	AB	Diluent	2786.5	2	$0.52	$1.50	$8.17	$0.12	$1.50		$11.80
2	St John	NB	Fort McMurray	AB	Diluent	3265.7	2		$1.50	$10.21	$0.12	$1.50		$13.33
2	Kitimat	BC	Fort McMurray	AB	Diluent	1197.2	2		$1.50	$3.99	$0.12	$1.50		$7.11
2	Benicia	CA	Fort McMurray	AB	Diluent	2071.6	2		$1.50	$5.93	$0.12	$1.50		$9.05
2	Vancouver	BC	Fort McMurray	AB	Diluent	1060.2	2		$1.50	$3.44	$0.12	$1.50		$6.56

Source: Hellerworx and ICF International.

Notes:

Estimated Rail Freight Charges

Estimated rail freight rate (including fuel surcharge) is estimated based on adding contribution margin of 46% to long run variable costs.

A 46% margin over long run variable costs (LRVC) is based on an average contribution margin for crude oil (Standard Transportation Commodity Code [STCC] 13) reported on US STB Commodity Stratification Report for 2011 (STB Railroad 2011).

Railroad long run variable costs are based on:

Trains of 101 cars (100 tank cars and 1 buffer car) and 3 locomotives.

Trains are loaded by origin terminal and unloaded by destination terminal with minimal Class I railroad switching.

Railroad locomotives stay with the train during loading and unloading process.

For some movements, one or more of the railroads may use more locomotives or a different configuration with a distributed power unit and second buffer car on the rear end.

$0 mileage payout for the railcars.

LRVC is estimated using Travacon Ltd. cost model escalated to Q2 2013 based on RCAF-U.

1 **For Lynton - Natchez Manifest Trains**

24-car blocks, pulled, spotted once/day.

Uniform rail cost system (URCS) average switch minutes and trains.

2 **For Diluent Movements**

Diluent could be Eagle Ford condensate, naphtha, natural gasoline, or other products.

Coiled/insulated tanks - same specs as used for railbit and bitumen.

All diluent moves are in railcars that moved head haul with crude.

Two days added to round trip cycle time (1 day on each end) to load/unload diluent. Diluent car cost includes only the 2 additional days.

For refinery-direct rail movements (Reybold, Los Angeles, St. John), refinery would reload the inbound trains with diluent.

For terminal locations, refinery ships diluent back to crude unloading terminal via the reverse route used for inbound crude (pipe or barge).

At the diluent origin terminal, diluent is loaded into an empty train that arrived loaded with crude (i.e., no repositioning of trains).

At Fort McMurray or Lynton, diluent is unloaded from trains at the rail terminal that will load the next shipment of crude oil (i.e., no repositioning of trains).

Loading and unloading diluent cost = $1.50/barrel—same as for loading/unloading crude.

Long run variable costs (LRVC) for diluent movements is estimated based on one-way movement with no switching since switching costs are accounted for in round-trip costs for crude oil movements.

Train specs, routes, miles, etc. are the same as for loaded movements.

Railcars

Railcar specifications and loading capacity are based on a general service tank car and insulated tank car currently moving in crude oil service.

Railcar lease cost per month is based on actual recent quotes for a 7-year lease: $1,200/month.

Railcar Cycle Times

Transit times are based on Hellerworx experience.

Rail terminal loading is based on ICF estimate of 0.5 day for Bakken and dilbit, 1 day for railbit and bitumen.

Rail terminal unloading is based on ICF estimate of 0.5 day for Bakken and dilbit, 1 day for railbit and bitumen.

Railcar Loading and Unloading Costs

Railcar loading and unloading costs are estimated based on ICF and Hellerworx experience.

Product and Loading Specifications

Bakken and dilbit move in general service tank cars.

Railbit, bitumen, and diluent move in insulated tank cars with heating equipment.

Tank cars are loaded to capacity.

Table C2 Estimated Crude Oil Capacity for 268,000-pound Tank Car

		Bakken GS Tank	Dilbit GS Tank	Railbit Insulated Tank	Bitumen Insulated Tank	Diluent Insulated Tank
Volume capacity	gal	31,172	31,172	28,413	28,413	28,413
Tare weight	pound	75,300	75,300	81,600	81,600	81,600
Maximum load	pound	192,700	192,700	186,400	186,400	186,400
Total gross weight limit	pound	268,000	268,000	268,000	268,000	268,000
Gallons/bbl		42	42	42	42	42
API		42	22	14.2	8.4	60
	lb/gal	6.79	7.69	8.105	8.44	6.15
Maximum	gal/car	28,380	25,059	22,998	22,085	28,413
Maximum	bbl/car	676	597	548	526	677

Table C3 Estimated Crude Oil Capacity for 286,000-pound Tank Cars

		Bakken GS Tank	Dilbit GS Tank	Railbit Insulated Tank	Bitumen Insulated Tank	Diluent Insulated Tank
Volume capacity	gal	31,172	31,172	28,413	28,413	28,413
Tare weight	pound	85,300	85,300	91,600	91,600	91,600
Maximum load	pound	200,700	200,700	194,400	194,400	194,400
Total gross weight limit	pound	286,000	286,000	286,000	286,000	286,000
Gallons/bbl		42	42	42	42	42
API			22	14.2	8.4	60
	lb/gal	6.79	7.69	8.105	8.44	6.15
Maximum	gal/car	29,558	26,099	23,985	23,033	28,413
Maximum	bbl/car	704	621	571	548	677

Table C4 Keystone XL Maximum Capacity Train Estimates

	Dilbit 268	Dilbit 286	Railbit 268	Railbit 286	Rawbit 268	Rawbit 286
Barrels per car	597	625	550	575	525	550
100 Cars per Train						
Barrels per train	59,700	62,500	55,000	57,500	52,500	55,000
Barrels per day	830,000	830,000	705,500	705,500	581,000	581,000
Loaded trains per day	13.9	13.3	12.8	12.3	11.1	10.6
Empty trains	13.9	13.3	12.8	12.3	11.1	10.6
Total trains per day	27.8	26.6	25.7	24.5	22.1	21.1
120 Cars per Train						
Barrels per train	71,640	75,000	66,000	69,000	63,000	66,000
Loaded trains	11.6	11.1	10.7	10.2	9.2	8.8
Total trains	23.2	22.1	21.4	20.4	18.4	17.6

Table C5 Pipelines All Constrained Scenario Train Traffic Estimates for 2035 Western Canadian Production: 268,000-pound Gross Weight Cars, 100-Car Unit Train

Destination Area	Projected Millions of Barrels per Day	Loaded Trains per Day	Empty Trains per Day	Total Trains per Day
Dilbit				
BC West Coast	760,000	12.73	12.73	25.46
U.S. PNW	750,000	12.56	12.56	25.12
U.S. California	570,000	9.55	9.55	19.10
U.S. Gulf Coast - Other	1,040,000	17.42	17.42	34.84
U.S. Gulf Coast - Houston	850,000	14.24	14.24	28.48
U.S. East Coast	150,000	2.51	2.51	5.02
Eastern Canada	380,000	6.37	6.37	12.74
Total	4,500,000	75.38	75.38	150.76
Railbit				
BC West Coast	646,000	11.75	11.75	23.49
U.S. PNW	637,500	11.59	11.59	23.18
U.S. California	484,500	8.81	8.81	17.62
U.S. Gulf Coast - Other	884,000	16.07	16.07	32.15
U.S. Gulf Coast - Houston	722,500	13.14	13.14	26.27
U.S. East Coast	127,500	2.32	2.32	4.64
Eastern Canada	323,000	5.87	5.87	11.75
Total	3,825,000	69.55	69.55	139.09
Rawbit				
BC West Coast	532,000	10.13	10.13	20.27
U.S. PNW	525,000	10.00	10.00	20.00
U.S. California	399,000	7.60	7.60	15.20
U.S. Gulf Coast - Other	728,000	13.87	13.87	27.73
U.S. Gulf Coast - Houston	595,000	11.33	11.33	22.67
U.S. East Coast	105,000	2.00	2.00	4.00
Eastern Canada	266,000	5.07	5.07	10.13
Total	3,150,000	60.00	60.00	120.00

Table C6 Pipelines All Constrained Scenario Train Traffic Estimates for 2035 Western Canadian Production: 286,000-pound Gross Weight Cars, 120-Car Unit Train

Destination Area	Projected Millions of Barrels per Day	Loaded Trains per Day	Empty Trains per Day	Total Trains per Day
Dilbit				
BC West Coast	760,000	10.13	10.13	20.27
U.S. PNW	750,000	10.00	10.00	20.00
U.S. California	570,000	7.60	7.60	15.20
U.S. Gulf Coast - Other	1,040,000	13.87	13.87	27.73
U.S. Gulf Coast - Houston	850,000	11.33	11.33	22.67
U.S. East Coast	150,000	2.00	2.00	4.00
Eastern Canada	380,000	5.07	5.07	10.13
Total	4,500,000	60.00	60.00	120.00
Railbit				
BC West Coast	646,000	9.36	9.36	18.72
U.S. PNW	637,500	9.24	9.24	18.48
U.S. California	484,500	7.02	7.02	14.04
U.S. Gulf Coast - Other	884,000	12.81	12.81	25.62
U.S. Gulf Coast - Houston	722,500	10.47	10.47	20.94
U.S. East Coast	127,500	1.85	1.85	3.70
Eastern Canada	323,000	4.68	4.68	9.36
Total	3,825,000	55.43	55.43	110.87
Rawbit				
BC West Coast	532,000	8.06	8.06	16.12
U.S. PNW	525,000	7.95	7.95	15.91
U.S. California	399,000	6.05	6.05	12.09
U.S. Gulf Coast - Other	728,000	11.03	11.03	22.06
U.S. Gulf Coast - Houston	595,000	9.02	9.02	18.03
U.S. East Coast	105,000	1.59	1.59	3.18
Eastern Canada	266,000	4.03	4.03	8.06
Total	3,150,000	47.73	47.73	95.45

ATTACHMENT 2, U.S. ENERGY INFORMATION ADMINISTRATION MEMO: THE NORTH AMERICAN OIL MARKET OUTLOOK, JANUARY 4, 2013

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Department of Energy
Washington, DC 20585
January 4, 2013

MEMORANDUM FOR: DAVID SANDALOW
ASSISTANT SECRETARY FOR POLICY AND INTERNATIONAL AFFAIRS

FROM: ADAM E. SIEMINSKI
ADMINISTRATOR
U.S. ENERGY INFORMATION ADMINISTRATION

SUBJECT: THE NORTH AMERICAN OIL MARKET OUTLOOK

This memorandum responds to your request for an overview of the latest U.S. Energy Information Administration's (EIA) outlook for North American oil markets through 2025 and changes in the outlook over the past several years. The requested information is provided below, reflecting comparisons of projections in the *Annual Energy Outlook 2013* (AEO2013) Reference case issued in December 2012 to those in prior AEO editions.

The AEO2013 Reference case reflects some important updates, including more rapid near-term growth in U.S. tight oil production, a lower near-term trajectory for oil prices, and reduced U.S. gasoline demand due to higher vehicle efficiency. However, these updates do not alter some of the major implications of earlier projections, including continued U.S. dependence on imported crude oil supplies, growing global demand, long-term rising oil prices, growth in Canadian oil sands production, and continued demand for heavy crude by U.S. Gulf Coast refiners even as traditional sources from Mexico and Venezuela continue their recent declines. Key observations regarding demand and supply are summarized below.

Demand:

- The AEO2013 global demand projection is 105.3 million barrels per day in 2025, 3.7% higher than the AEO2012 projection and 1.6% above the AEO2011 projection. Nearly all of the growth in global liquids demand in of these AEO editions is attributable to non-OECD Asia and the Middle East.
- The AEO2013 U.S. demand projection is 19.5 million barrels per day for 2025, 1.6% higher than the AEO2012 projection and 7.1% below the AEO2011 projection. The increase in AEO2013 relative to AEO2012 largely reflects a rise in energy-intensive manufacturing which raises petroleum use in the form of natural gas liquids and diesel fuel for trucks even as projected gasoline use is reduced by new fuel economy standards.

Supply, Imports, and Refining:

- AEO2013 projects U.S. crude oil production of 7.5 million barrels per day in 2019, 13% above the AEO2012 projection. However, tight oil production declines after 2020 as development moves into lower-productivity areas, and the AEO2013 projection for U.S. crude production beyond 2025 is similar to that in AEO2012. AEO2011 has a somewhat lower production profile than either AEO2013 or AEO2012.
- In AEO2013, as in AEO2012 and AEO2011, the United States remains a significant net importer of petroleum in 2025 and beyond, with about one-third of U.S. demand satisfied by imports in 2025.
- In AEO2013, as in AEO2012 and AEO2011, growth in Canadian oil sands remains a key factor in maintaining robust non-OPEC supply over the course of the next several decades. Projected levels of total Canadian production in 2025 are in a narrow band from 5.3 and 5.6 million barrels per day across these three AEOs.
- AEO2013, AEO2012, and AEO2011 projections for Mexico's oil production in 2025 are very similar, falling into a range of 1.3 to 1.6 million barrels per day. Projected 2025 production in all three AEO editions is below the current level.
- With U.S. Gulf Coast refineries optimized for the use of heavy/sour crude oil, the regional demand for heavier grades of oil in the U.S. Gulf Coast remains strong through 2025. Continuing recent trends, heavy oil supplies from Mexico and Venezuela continue to decline.

Background
The *Annual Energy Outlook 2013* (AEO2013) Reference case published in December 2012 presents long-term projections of energy supply, demand, and prices through 2040 based on results from EIA's National Energy Modeling System. The complete AEO2013 to be released in the spring of 2013 will include a full range of cases exploring key uncertainties in the Reference case.

Oil Demand
The increase in EIA's Reference case projection for 2025 global oil demand between AEO2012 and AEO2013 is attributable to a more robust economic growth outlook for developing nations outside the Organization for Economic Cooperation and Development (OECD) and somewhat lower projections for oil prices over the next decade. The difference in global demand attenuates by 2035 (110.3 million barrels per day in AEO2013 against 109.5 million barrels per day in AEO2012) but in both cases EIA sees continuing growth in long-term world liquid fuels consumption despite rising world oil prices. Nearly all of the global increase in total liquids consumption is projected for the nations of non-OECD Asia and the Middle East, where strong economic growth and, in the case of the Middle East, access to ample and relatively inexpensive domestic resources, drive the increase in demand.

AEO2013 incorporates the new efficiency standards for light-duty vehicles in the United States through the 2025 model year, which reduces gasoline use in the transportation sector by 0.5 million barrels per day in 2025 and by 1.0 million barrels per day in 2035 in AEO2013 compared to the AEO2012 Reference case. As noted above, a rise in energy-intensive manufacturing that raises petroleum use in the form of natural gas liquids and diesel fuel for trucks has opposing effects on the demand for petroleum products. Overall U.S. petroleum product demand is relatively flat over the next 25 years in both the AEO2013 and AEO2012 projections.

Oil Supply
U.S. production of crude oil in the AEO2013 reference case increases from 5.7 million barrels per day in 2011 to 7.5 million barrels per day in 2019, 13% higher than in AEO2012. Despite a decline after 2019, U.S. crude oil production remains above 6.0 million barrels per day through 2040. Higher volumes from increased onshore oil production come predominantly from tight (very low permeability) formations. In AEO2013, onshore tight oil production accounts for 51% of total lower 48 states onshore oil production in 2040, up from 33% in 2011. Offshore crude oil production trends upward over time, fluctuating between 1.4 and 1.8 million barrels per day, as the pace of development quickens and new large development projects, predominantly in the deep and ultra-deep portions of the Gulf of Mexico, are brought into production.

The faster growth of tight oil production through 2020 in AEO2013 results in higher domestic crude oil production than forecast in AEO2012 throughout most of the projection. Tight oil production declines after 2020 as more development moves into lower-productivity areas (with lower initial production rates and flatter decline curves), resulting in flattening of production after 2030. Total U.S. liquids production in AEO2013 is higher than in AEO2012 due to increased tight oil production through 2025; however, lower production of biofuels and natural gas plant liquids, as well as the decline in tight oil production beginning in 2021, results in lower levels of total domestic liquids production after 2025 in AEO2013 than in AEO2012.

EIA's AEO2013 Reference case projects the Organization of the Petroleum Exporting Countries' (OPEC) share of total global supply to increase from 40.0% in 2011 to 44.2% in 2040. The AEO2012 estimated OPEC's share at 41.3% in 2025, while the AEO2013 pushes OPEC's share higher to 42.2% in 2025. Thus, recent optimism regarding U.S. production prospects does not challenge OPEC's role, or mitigate the robustness of market pressures to increase all sources of non-OPEC supply. A number of non-OECD producers, including Russia and other countries within the former Soviet Union, as well as Brazil, China, and a host of small African producers, are expected to see their combined share of total supply fall by an amount roughly equal to the OPEC increase between 2011 and 2040.

U.S. Imports

In both the AEO2012 and 2013, the United States remains a significant net importer of petroleum in 2025 and beyond, with about one-third of U.S. demand satisfied by net imports. In the AEO2013 reference case, U.S. net imports of liquids in 2025 are projected at 7.1 million barrels per day, the same level as in AEO2012, but 2.1 million barrels per day lower than had been projected in AEO2011. U.S. dependence on net imports of liquid fuels declines in the AEO2013 Reference case, primarily as a result of increased domestic oil production. Net liquid fuels imports as a share of total U.S. liquid fuel use exceeded 60% in 2005 before dipping below 50% in 2010 and falling further to 45% in 2011. The projected net import share in the AEO2013 Reference case bottoms at 34% in 2019 and then rises to about 37% in 2040, due to a decline in domestic production of tight oil that begins in about 2021. Differences between the AEO2013 and AEO2012 forecasts for U.S. net dependence on oil imports in 2025 and beyond are relatively minor.

U.S. Gulf Coast Refining

Many U.S. refineries are located close to crude oil production centers such as the Gulf Coast or near major population centers where much of the demand for petroleum products is concentrated (e.g., California and the areas near Philadelphia, New York City, and Chicago). Of the more than 17.5 million barrels per day of U.S. refinery capacity in 2012, about 44% is located along the Gulf Coast. Many Gulf Coast refineries have extensive secondary conversion capacity including hydrocrackers, cokers, and desulfurization units that enable the processing of heavy, high sulfur (sour) crude oils. Most East Coast refineries have less secondary conversion capacity, and, in general, they process crude oil with lower sulfur content and a lighter density (light sweet oil).

In recent years, oil production has risen dramatically in both the United States (light sweet crude, especially from the Bakken and Eagle Ford formations) and Canada (heavy sour grades from the Alberta oil sands). Although light sweet grades traditionally sell at a premium to heavy sour grades, inland light sweet oil that is subject to transportation bottlenecks has been heavily discounted in recent years. Refineries across the country are developing strategies to acquire and transport inland light sweet crude streams to replace more expensive imports of high-quality crude oil. At the same time, many Gulf Coast refiners are also seeking more access to Canadian oil to replace declining supplies of heavy crude from Mexico and Venezuela. As currently configured, many such refiners would experience lower utilization rates and produce less desirable product slates if they were to run light sweet crude, which also still sells at a premium to heavy grades in coastal locations.

AEO2013, AEO2012, and AEO2011 all project continued strong demand for heavy sour crudes from Gulf Coast refiners that are optimized to process such oil. While the AEO does not identify specific supply sources for the imported crude used by U.S. refiners, Canada is certainly a likely source for heavy grades. Importantly, the projection for rising Canadian oil sands production in the Reference case of all recent AEO editions is not predicated on the completion of any particular infrastructure project. Increased rail transport utilizing infrastructure that is already in place, appears to be a viable option for moving production over long distances to reach the Gulf Coast and other markets, as evidenced by the extremely rapid growth in the volume of rail shipments of domestic Bakken crude to a variety of markets over the past year. While rail shipment is somewhat more costly than pipeline shipment, the Bakken experience suggests that the absence of pipeline take away capacity will not forestall profitable production projects.

Reference Case Liquids Projections for 2025
Comparison of Recent Annual Energy Outlook Editions

	AEO2010	AEO2011	AEO2012	AEO2013
Total World Liquids Consumption (mmb/d)	100.7	97.1	101.5	105.3
OPEC Market Share (%)	41.6%	42.0%	41.3%	42.2%
U.S. Crude Oil Production (mmb/d)	6.1	5.9	6.4	6.8
Lower 48	5.4	5.5	6.0	6.4
Lower 48 Onshore	3.2	3.9	4.4	5.0
Lower 48 Offshore	2.1	1.6	1.6	1.5
Alaska	0.7	0.4	0.4	0.4
Other Petroleum and Non-Petroleum Supply excluding net imports (mmb/d)	4.9	5.8	5.8	5.6
U.S. Liquids Demand (mmb/d)	21.0	21.0	19.2	19.5
U.S. Net Liquids Imports (mmb/d)	9.8	9.2	7.1	7.1
U.S. Net Import Share of Demand (%)	47.1%	44.0%	37.0%	36.3%
Canada Oil Production (mmb/d)	5.1	5.3	5.5	5.6
Mexico Oil Production (mmb/d)	1.9	1.3	1.6	1.6

Source: U.S. Energy Information Administration

ATTACHMENT 3, COMPARATIVE TRANSPORTATION COSTS FOR PIPELINES AND RAIL: WESTERN CANADA TO U.S. GULF COAST BY ICF INTERNATIONAL

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COMPARATIVE TRANSPORTATION COSTS FOR PIPELINES AND RAIL
WESTERN CANADA TO US GULF COAST

There have been numerous documents published on costs to move bitumen to the U.S. Gulf Coast (USGC) and other markets by pipeline in the form of "diluted bitumen" – or "dilbit" – or by rail (as dilbit, raw bitumen, or "railbit", a 15% diluent blend with bitumen). ICF was asked by the U.S. State Department to analyze the cost to move a barrel of bitumen by pipeline from Hardisty/Lloydminster, Alberta to refining locations on the USGC and compare it to the cost to move a barrel of bitumen by rail from the same origin to the same destination. The purpose of this exercise is to assess the comparative costs and determine the basis for some shippers opting to move bitumen by rail (bitumen or blended as railbit) rather than by pipeline (blended as dilbit).

ICF estimated the tariff by assuming shipments occurred on the existing Keystone pipeline from Hardisty to Cushing, Oklahoma, and then the volume would be transported from Cushing to Freeport, Texas and into Houston, Texas via the existing Enbridge/Enterprise Seaway pipeline system. These costs would be higher than a full transport on the Keystone system via KXL, however, they are true costs and provide a good benchmark based on existing logistics pathways.

TransCanada recently issued (December 2, 2013) a full pass tariff from Hardisty into Port Arthur, Texas via Cushing and the TransCanada Gulf Coast line, as that line will be active in January 2014. The lateral line into Houston, however, will not be operational until late 2014.

Results

The results indicate that shipment of bitumen via pipeline from Hardisty/Lloydminster will cost $18.38 per barrel (bbl) for volume shipped on a committed basis, and $25.30/bbl for volume shipped uncommitted.[1] These are costs on a bitumen equivalent basis although the crude would be shipped in the form of dilbit, which is comprised of 70% bitumen and 30% diluent. Keystone has indicated that over 1.1 million barrels per day (bbl/d) of their system capacity into the U.S. has been committed to long-term volume (over 15 years), with the balance of capacity (200,000-300,000 bbl/d) uncommitted. The pipeline cost estimate assumes the existing Keystone line into Cushing and then Seaway into the Houston market.

Rail movements of raw bitumen from Hardisty/Lloydminster to Port Arthur refineries or Houston refineries are estimated as $17.76/bbl and $19.18/bbl, respectively (assuming heated barges from a Port

[1] All currencies quoted are in United States Dollars unless otherwise noted.

Arthur rail offloading facility). Meanwhile, rail movements of “rail bitumen” or “railbit” (15% diluent/85% bitumen) to these refineries are $21.69/bbl and $23.27/bbl of bitumen, respectively.

Consequently, the results of this analysis indicate that bitumen movement by pipeline on a committed basis is roughly equivalent to rail movement costs. Parties who may commit to large volumes (refiners or large producers) would likely prefer pipeline movement due to the ease of shipment management and coordination. Producers who may have smaller volumes and have more uncertain production levels may not be able to commit to pipeline space in advance, and therefore may see rail movement of bitumen as both more economic and flexible for their business needs.

Analysis of the recently published full pass TransCanada tariff from Hardisty into Port Arthur indicates that, if the tariff were similar into Houston via the Houston lateral, the pipeline bitumen shipment costs for committed volumes would decline from $18.38/bbl to $16.14/bbl, and the uncommitted costs would decline from $25.30/bbl to $24.78/bbl. While the specific tariff into Houston via the lateral, as well as the full tariff for Keystone XL (if approved) have not been published, the full pass Port Arthur tariff indicates bitumen shipped on the Keystone system would have a lower delivered cost than other pipeline options and rail.

Sources

In analyzing the comparative costs of transporting bitumen from Western Canada to the USGC, ICF utilized a variety of public information sources to estimate each option with as much accuracy as possible. Published pipeline tariffs were used in many cases, along with marine and rail costs estimated by Poten and Partners (Marine) and Hellerworx (Rail).

A limited amount of information was secured from industry sources and public documents, and these are cited in the text.

The following discussion outlines each transport method and the associated costs to compare delivery options.

Pipeline Analysis

Committed Pipeline Tariff

In order to ship bitumen on a pipeline, it must be blended to meet pipeline specifications (i.e. viscosity requirements), so it is mixed with lighter material like natural gasoline to formulate a product known as “diluted bitumen” or “dilbit”. The tariff for a 20-year contract for heavy crude oil (including dilbit) from Hardisty to Cushing is $6.12/bbl[2,3] (assuming an exchange rate of US$0.97 to C$1.00) on the existing Keystone pipeline. At Cushing, the volume could be transported to Houston via the new TransCanada

[2] Petroleum Toll Schedule, NEB Tariff No. 8, Keystone Pipeline System. Effective: January 1, 2013.
[3] FERC ICA Oil Tariff, F.E.R.C. No. 6.7.0, TransCanada Keystone Pipeline, LP. Effective: July 1, 2013.

Gulf Coast pipeline lateral, however, a tariff has not yet been published. However, the Keystone barrels could move on the reversed Seaway pipeline into the Houston market via the Jones Creek, Texas destination. The tariff for a 10-year contract for heavy crude from Cushing to Jones Creek is $3.47/bbl on the Seaway Pipeline.[4] This delivers dilbit to Jones Creek, which would then move back north to Seaway's Texas City, Texas terminal (or the new ECHO terminal) for $0.398/bbl. From here, dilbit can access Houston area refineries for an additional charge of $0.14/bbl.

Therefore, the total tariff from Hardisty to Houston refineries via Keystone/Seaway is approximately $10.13/bbl. Based on TransCanada's recently issued tariff, the tariff to move heavy crude from Hardisty to Port Arthur would be $8.06/bbl (assuming an exchange rate of US$0.97 to C$1.00 and a volume conversion of 0.159 meters^3 = 1 barrel). Assuming the tariff into Houston via the Houston lateral would be similar, it is likely that the full pass Keystone tariff into Houston would be $8.56/bbl (including an estimated receipt and storage fee), or $1.57/bbl below the Keystone/Seaway cost.[5] However, this analysis will use the Keystone/Seaway cost of $10.13 as this is a defined route for Canadian crude, assumes a significant use of the Keystone system capacity, and will be a viable option for Houston area refiners.

[Note that the Keystone XL shipments will also have additional costs beyond the tariff to move crude into destination refineries. As an example, for deliveries into the Sun Nederland terminal for Port Arthur/Beaumont refineries, the cost for terminal throughput can vary from $0.12/bbl to $0.50/bbl, according to industry sources. The type of crude, fungibility of the crude, and the internal pumping needs contribute to the variability. Most local refiners have proprietary pipelines to move crude from Sun Nederland into their crude storage tanks, Sun delivers through their system to Motiva Port Arthur for a modest fee. Costs for Houston area receipt and storage are at this time unknown, but likely would be in the range of $0.50/bbl.]

Keystone Tariff:

The Keystone 20-year heavy crude tariff from Hardisty to Cushing is $6.12/bbl.

Hardisty, Alberta to Haskett, Manitoba[2]: $13.852\,\frac{C\$}{m^3} \times 0.97\,\frac{US\$}{C\$} \times 0.159\,\frac{m^3}{bbl} = US\$2.136\ per\ bbl\ dilbit$

Haskett, Manitoba to Cushing, Oklahoma[3]: $25.078\,\frac{US\$}{m^3} \times 0.159\,\frac{m^3}{bbl} = US\$3.987\ per\ bbl\ dilbit$

Seaway Tariff:

The Seaway 10-year heavy crude tariff for quantities less than 100,000 bbl/d is $3.47/bbl.[6,7] An additional $0.398/bbl transports the crude from Jones Creek to Seaway's Texas City terminal.[8] From

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[4] A 20-year tariff for committed shippers is not included in Seaway's tariff schedule.
[5] FERC ICA Oil Tariff, F.E.R.C. No. 6.9.0, TransCanada Keystone Pipeline, LP. Effective: January 3, 2014.
[6] Seaway, Cushing to USGC is $3.40 tariff for 10-year heavy crude contract <100,000 b/d for an incremental committed shipper that has executed a transportation services agreement as of February 10, 2012 + $0.07 power charge.
[7] FERC ICA Oil Tariff, FERC No. 2.5.0, Seaway Crude Pipeline Company LLC. Effective: August 15, 2013.
[8] FERC ICA Oil Tariff, FERC No. 411.4.0, ExxonMobil Pipeline Company. Effective: July 1, 2013.

here, an additional cost of $0.14/bbl transports the crude to local Houston refineries.[9] The total cost along the Seaway portion of this route is $4.01/bbl.

In addition to the Keystone-based route for dilbit, crude could also travel from Hardisty to the USGC through two Enbridge pipeline systems (Mainline and Spearhead) that feed into the Seaway pipeline at Cushing. The total cost to ship crude using this route would be $9.11/bbl (as calculated below). A shipper's decision regarding which option to use would largely depend on relative costs, injection/receipt points, and capacity availability. This analysis uses the Keystone/Seaway route because it is not clear if the Enbridge/Seaway route would have the capacity to handle both planned Enbridge/Spearhead volumes and incremental volumes committed to Keystone XL.

Enbridge Mainline Tariff:

The Mainline tariff is a heavy crude pipeline tariff rate.

Hardisty, Alberta to Flanagan, Illinois[10]: $25.3317 \frac{US\$}{m^3} \times 0.159 \frac{m^3}{bbl} = US\$4.028\ per\ bbl\ dilbit$

Enbridge Spearhead Tariff:

The Spearhead tariff is $1.141/bbl on a committed volume basis of more than 10,000 bbl/d. If the shipper opts to utilize the Mainline system as well, they are offered a discount of $0.0681/bbl. As a result, the cost of shipping dilbit from Flanagan, Illinois to Cushing it $1.073/bbl.

Seaway Tariff:

As calculated previously, the pipeline cost for Seaway movements from Cushing into Houston refiners is $4.01/bbl.

Uncommitted Pipeline Tariff

There are various options in contracting capacity on pipelines. These contracts can vary depending on quality of crude oil shipped, quantity of crude oil shipped, and duration of contract among other specifications. In addition to contracting long-term committed capacity on a pipeline, some shippers may elect to utilize capacity on a spot, or uncommitted, basis. This helps shippers avoid risk by not committing in advance to shipping crude that may not be available to them in the future (for example small producers who are unsure about future production rates). As a result, this option carries a cost premium. In order for these shippers to gain access to pipeline capacity, they must pay an "uncommitted pipeline tariff" that includes this premium.

According to the current Keystone and Seaway tariff schedules, the total uncommitted tariff can be as high as $14.97/bbl (a $4.84/bbl premium above the committed pipeline rate of $10.13).[2,3] This cost could be lower if the pipelines continue to offer temporary discounts to uncommitted shippers,

[9] Texas RRC No. 18, Seaway Crude Pipeline Company LLC. Effective: December 1, 2012.
[10] Enbridge Tariff Schedule, NEB No. 334 and FERC No. 45.2.0. Effective: July 1, 2013.

however, these discounts can be of limited duration and may not be reliable long-term. Consequently, this study will assume uncommitted volumes are shipped at the published uncommitted rate.

This analysis covers both scenarios, though it is expected that most of the capacity on Keystone XL is contracted on a committed basis. TransCanada cited in 2011 that they had over 1.1 million bbl/d of commitments for long-term shipment on their system into the U.S. (which included the original Keystone pipeline and the Keystone XL pipeline, over 1.3 million bbl/d in combined capacity).

Keystone Tariff:

The uncommitted crude tariff for heavy crude from Hardisty to Cushing is $9.91/bbl and calculated as follows.

Hardisty, Alberta to Haskett, Manitoba[2]: $17.029\frac{C\$}{m^3} \times 0.97\frac{US\$}{C\$} \times 0.159\frac{m^3}{bbl} = US\$2.626\ per\ bbl\ dilbit$

Haskett, Manitoba to Cushing, Oklahoma[3]: $45.8173\frac{US\$}{m^3} \times 0.159\frac{m^3}{bbl} = US\$7.285\ per\ bbl\ dilbit$

Seaway Tariff:

The Seaway uncommitted heavy crude tariff from Cushing to Jones Creek is $4.52/bbl.[11] As outlined in the committed rate section, an additional $0.398/bbl transports the crude from Jones Creek to Seaway's Texas City terminal.[12] A subsequent charge of $0.14/bbl transports the crude to local Houston refineries.[13] The total uncommitted Seaway tariff is $5.06/bbl.[7]

The total uncommitted tariff along the Keystone/Seaway route is $14.97/bbl, an increase of about $4.84 over the committed rate.

Penalty for Transporting Diluent South

There is an inherent penalty in transporting dilbit as opposed to pure bitumen as only 70% of the dilbit is crude that will be processed into finished products. In order to account for this penalty, an adjustment is made to the $10.13/bbl tariff for the Keystone/Seaway pathway assuming that the dilbit is transported using a long-term contract. As noted earlier, Keystone XL volume is expected to be largely comprised of long-term commitments from shippers based on initial demand. As a result, the cost of transporting the diluent south is $4.34/bbl of bitumen on a committed basis.

$$\frac{0.3\ \frac{bbl\ of\ diluent}{bbl\ of\ dilbit} \times (US\$10.13)}{0.7\ \frac{bbl\ of\ bitumen}{bbl\ of\ dilbit}} = US\$4.34\ per\ bbl\ bitumen$$

[11] FERC ICA Oil Tariff, FERC No. 2.5.0, Seaway Crude Pipeline Company LLC. Effective: August 15, 2013.
[12] FERC ICA Oil Tariff, FERC No. 411.4.0, ExxonMobil Pipeline Company. Effective: July 1, 2013.
[13] Texas RRC No. 18, Seaway Crude Pipeline Company LLC. Effective: December 1, 2012.

However, if the dilbit is to be transported on an uncommitted basis, the cost would increase to \$6.42/bbl of bitumen assuming the full uncommitted rate of \$14.97/bbl.

$$\frac{0.3\,\frac{bbl\ of\ diluent}{bbl\ of\ dilbit} \times (US\$14.97)}{0.7\,\frac{bbl\ of\ bitumen}{bbl\ of\ dilbit}} = US\$6.42\ per\ bbl\ bitumen$$

[Note that use of an estimated lower tariff via the Houston lateral of about \$1.57/bbl would reduce committed diluent cost by about \$0.67/bbl from \$4.34/bbl of bitumen to \$3.67/bbl of bitumen.]

Uncommitted Pipeline Tariff Premium

The additional cost associated with transporting dilbit on an uncommitted basis is separated in this analysis to identify the impact of this added cost. Based on the methodology deployed above, the cost for shipping dilbit on this basis is the total cost of shipping crude on an uncommitted basis (Keystone tariff + Seaway tariff + penalty for transporting diluent south) less the total cost of shipping crude on a committed basis. This cost is \$6.91/bbl bitumen.

$$(US\$9.91/bbl + US\$5.06/bbl + US\$6.42/bbl) - (US\$6.12/bbl + US\$4.01/bbl + US\$4.34/bbl) = US\$6.91\ per\ bbl\ bitumen$$

Line Fill and Storage

Assuming a transit time of 20 days for each barrel from Hardisty to the USGC and an interest rate of 6%, this would translate to \$0.38/bbl of bitumen transported (assuming a dilbit price of \$80/bbl).[14]

$$\frac{US\$80 \times 6\% \times 20\ days}{0.7\,\frac{bbl\ of\ bitumen}{bbl\ of\ dilbit} \times 365\ days} = US\$0.38\ per\ bbl\ bitumen$$

The need for storage costs is not obvious; crude must be held to inject into pipelines. For most pipelines, if the shipper places volume in the shipper storage tanks for injection in the pipeline there is no fee for this above the pipeline tariff.

Transporting Diluent North

In addition to assessing the tariff impact of shipping 30% diluent with the bitumen (above calculation), the cost to acquire diluent in Alberta must be considered in determining the full cost to ship bitumen by pipeline. The producer would normally secure diluent from the most economic source. This could be by purchasing diluent locally in Alberta, or by purchasing diluent in other markets and then transporting it to Alberta. Refiners may also work with producers to return diluent to Alberta via existing and planned pipeline routes to essentially "recycle" diluent. This is believed to be how BP's Whiting, Indiana refinery is returning diluent to Alberta.

[14] TransCanada Pipeline Operations Source.

For this analysis we assume the recycle method is used because it in fact is planned to be used and Gulf Coast refiners have options to access pipelines to ship the diluent back to Alberta.

The cost of shipping the diluent north from the USGC to Hardisty is developed as follows. The tariff (regular rate) on the Explorer pipeline from Port Arthur (Jefferson County) to Peotone, Illinois is \$2.188/bbl.[15] Although not connected at present, Explorer expects the 18-mile connection to Enbridge to be operational to move diluent into the Enbridge Southern Lights pipeline at Manhattan, Illinois by the second quarter 2015.[16] The committed diluent tariff on the Enbridge Southern Lights pipeline from Manhattan to the international border is \$4.2379/bbl.[17] From the international border to Hardisty the tariff is C\$1.88/bbl of diluent.[18] This means that the total cost of transporting one barrel of diluent from Jefferson County to Hardisty is equal to \$8.2495/bbl of diluent (assuming an exchange rate of US\$0.97 to C\$1.00) or \$3.54/bbl of bitumen transported.

$$\frac{0.3\,\frac{bbl\ of\ diluent}{bbl\ of\ dilbit} \times (\$8.2495)}{0.7\,\frac{bbl\ of\ bitumen}{bbl\ of\ dilbit}} = US\$3.54\ per\ bbl\ bitumen$$

This analysis assumes that the diluent transported would be of sufficient quality to produce a nominal 20^{o} API Western Canadian Select (WCS) crude at a 30% blend ratio. Producers could alternatively purchase diluent locally in the Alberta market. The best option may vary based on the relative costs for diluent in the USGC and Alberta markets and the specific type of diluent being blended (for example a lighter diluent may cost more but require a lower blend ratio).

It is widely believed that future oil sands production of bitumen will require substantial volumes of diluent to be transported into Alberta. The source of these shipments is most likely pipelines such as the Explorer pipeline from the USGC connecting to the Enbridge Southern Lights or Kinder Morgan Cochin pipelines in Illinois moving diluent into Alberta. Rather than speculating on potential future price differentials between Alberta and the USGC

BP CAPLINE

An alternative to Explorer pipeline would be using BP's Capline pipeline, which runs from St. James, Louisiana to the Chicago area. Capline has a slightly lower tariff than Explorer (about \$0.30/bbl to \$0.60/bbl lower), however, Capline is really only accessible to refiners in the New Orleans/Baton Rouge market, and must also be accessed by barge, which may offset the slight tariff advantage. Moreover, Explorer can be accessed directly by refiners from the Lake Charles, Port Arthur, and Houston markets, capturing the bulk of destination markets for oil sands crude.

Source: FERC ICA Oil Tariff, FERC No. 126.5.0, BP Oil Pipeline Company. Effective: July 1, 2013.

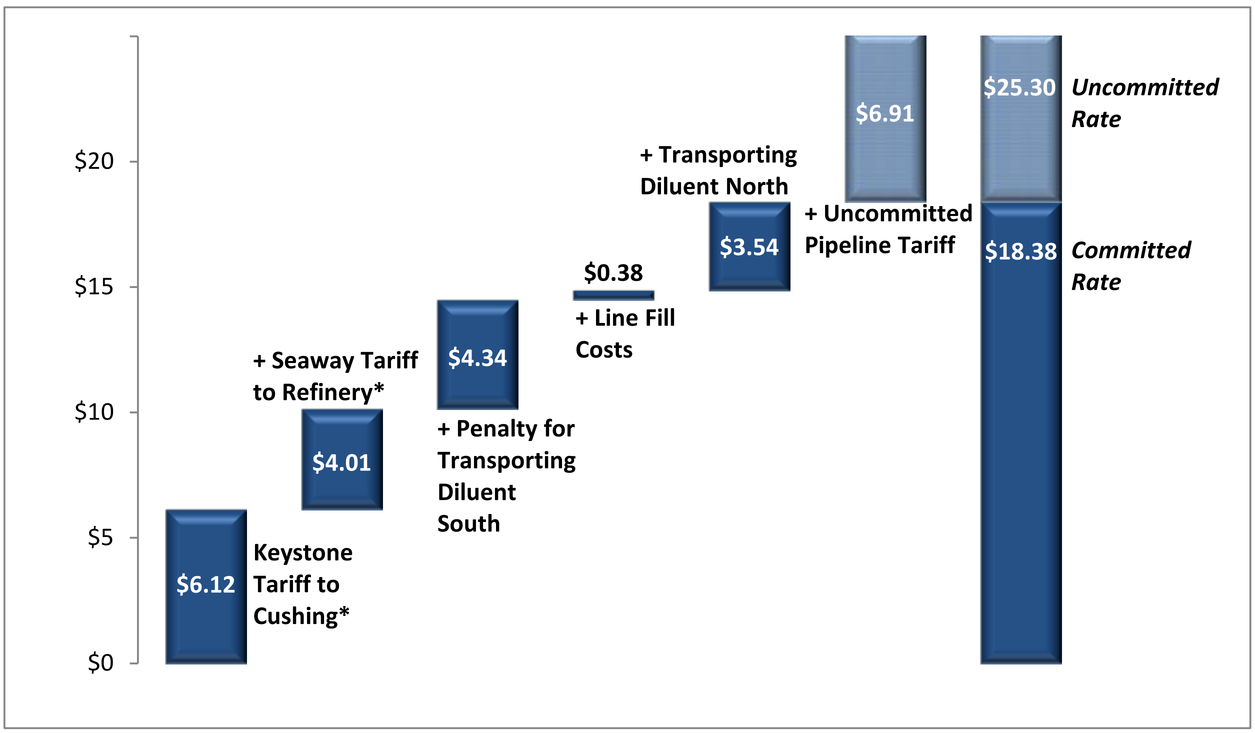
[15] FERC No. 100.19.0, Explorer Pipeline Company. Effective: August 1, 2013.
[16] "Explorer Pipeline Approves Funding for Manhattan Extension Project," Explorer Pipeline. April 2, 2013. Accessed: August 23, 2013. http://www.expl.com/News.aspx
[17] FERC ICA Oil Tariff, FERC No. 4.10.0, Enbridge Pipelines LLC. Effective: July 5, 2013.
[18] Tolls Applying on Diluent, NEB No. 9. Enbridge Southern Lights GP. Effective: July 1, 2013.

(which could be widely different if oil sands bitumen moves more by rail than pipeline), this analysis uses the pipeline cost for shipments from the USGC as an indicator of the added cost of supplying diluent for pipeline movements.

Pipeline Summary

The pipeline costs outlined above are aggregated in the figure below. Summing these costs, we find that the cost to move bitumen by pipeline to the USGC is $18.38/bbl of bitumen on a committed basis and $25.30/bbl of bitumen on an uncommitted basis. This analysis reaches a somewhat similar conclusion that Raymond James via Canexus did, who cites a cost of $17.50/bbl for large shippers and $25.75/bbl for small shippers on pipelines.[19] The waterfall chart below shows the buildup of these costs.

Figure 1: Pipeline Economics (Western Canada to the USGC), US$/bbl of Bitumen (unless noted)



Note: costs may not sum due to independent rounding.
***Cost is shown in $ per dilbit barrel.

Rail Analysis

Another option for transporting bitumen to refineries in the USGC is to ship the raw bitumen by rail. This option includes greater flexibility for producers and shippers who may not want to commit to using a pipeline for a significant length of time, but would rather operate on more of a spot basis. Transporting raw bitumen by railcar has the benefit of reducing the total volume being shipped by eliminating the

[19] "Driving Growth Delivering Returns," Canexus. May 9, 2013. Accessed: August 23, 2013. http://canexus.ca/documents/Canexus_AGM_2013.pdf

need for transporting diluent (both into and out of Alberta). This is offset by the higher cost to transport by rail and the challenge (cost) in moving a material that must be loaded, transported, and unloaded as a heated product so that it will flow.

Another option that shippers have to transport bitumen by rail is to blend it with diluent similarly to what pipeline shippers do. However, this "rail bitumen" or "railbit" is composed of less diluent (15%) than dilbit. The railbit has sufficient fluidity to load and transport in railcars, but it is believed to be too viscous for efficient pipeline transport.

Loading and Unloading Costs

The first step in transporting crude oil by rail is physically loading the crude onto unit trains. This step includes capital costs such as building or acquiring crude storage facilities, building or acquiring appropriate track space for incoming and outgoing unit trains, and associated equipment to load crude onto trains from storage tanks. Additional costs include maintenance, labor, and other variable costs associated with operating the facility.

Information from a variety of sources has been analyzed to identify the costs associated with loading unit trains. Many sources have indicated that rail loading facilities are charging around $1.50/bbl for these services, though this cost tended to be for lighter crude (i.e. Bakken) or blended crude (i.e. dilbit). Consequently, in order to capture a premium for handling and heating bitumen or railbit, an additional $0.25/bbl was included such that the total loading cost is estimated at $1.75/bbl.[20]

Similar to the loading process, the unloading process requires similar fixed and variable costs. Unloading costs were estimated as equal to the loading costs of $1.75/bbl.

Rail Freight

ICF (via Hellerworx[21]) estimated that the cost of rail freight (cost associated with utilizing the track) for bitumen from Hardisty/Lloydminster to Port Arthur to be $12.44/bbl. This estimate reflects a specific route and assumes that each railcar can haul a volume of product based on its API gravity and the railcar weight restrictions. Costs to ship a lighter crude would be lower since more barrels can be loaded on each railcar.

The cost of transporting railbit from Hardisty/Lloydminster to Port Arthur is estimated to be $11.95/bbl of railbit. Like bitumen, this estimate reflects the route taken. However, since this crude blend is lighter than pure bitumen, more can be transported under fixed weight restrictions, thus rendering it less expensive to transport on a per barrel of railbit basis.

[20] ICF's analysis of the actual fee required to pay out a rail loading or unloading terminal investment indicates that $1.50 per barrel (or $1.75 for bitumen) may be higher than the actual cost merits. However, the fees shown are what the current market is requiring for producers and refiners to pay for the use of the rail facilities, and it is unlikely those rates will fall in the near term.

[21] Hellerworx provided rail freight and lease estimates for this study. www.hellerworx.com/

Railcar Lease

Hellerworx estimated the railcar lease fee to be $1.13/bbl. In order for bitumen to stay in a liquid (or semi-liquid) state, it must be heated to prevent it from solidifying. Railcars shipping bitumen must be equipped with heaters and are more expensive than railcars shipping other types of crude oils.

As with the railcar freight cost, transporting railbit is slightly less expensive than transporting pure bitumen as cars do not need to have as much heating ability. As a result, the railcar lease fee was estimated at $1.08/bbl of railbit.

Penalty for Transporting Diluent South

As discussed in the pipeline section, there is an inherent penalty in transporting railbit as opposed to pure bitumen as only 85% of the railbit is crude that will be processed into finished products. An adjustment is made in order to account for this penalty. The total cost of transporting railbit to the USGC (not including subsequent movements to refineries), including loading and unloading, is $16.53/bbl (loading + rail freight + railcar lease + unloading). As a result, the cost of transporting the diluent south is $2.92/bbl of bitumen.

$$\frac{0.15\ \frac{bbl\ of\ diluent}{bbl\ of\ railbit} \times (US\$16.53)}{0.85\ \frac{bbl\ of\ bitumen}{bbl\ of\ railbit}} = US\$2.92\ per\ bbl\ bitumen$$

Rail Fill

Similar to the pipeline analysis, there is a working capital holding cost associated with rail fill. Assuming a transit time of 8 days for each barrel from Western Canada to the USGC and an interest rate of 6%, this translates to $0.09/bbl of bitumen transported (assuming a bitumen price of $70/bbl).

$$\frac{US\$70 \times 6\% \times 8\ days}{365\ days} = US\$0.09\ per\ bbl\ bitumen$$

As railbit is slightly more expensive than pure bitumen due to the 15% of diluent included, there is a greater cost associated with working capital in-transit. Again assuming a transit time of 8 days for each barrel from Western Canada to the USGC and an interest rate of 6%, this translates to $0.12/bbl of bitumen transported (assuming a railbit price of $75/bbl).[22]

$$\frac{US\$75 \times 6\% \times 8\ days}{0.85\ \frac{bbl\ of\ bitumen}{bbl\ of\ dilbit} \times 365\ days} = US\$0.12\ per\ bbl\ bitumen$$

Destination Movements

Once crude oil arrives in the USGC it must be subsequently transported to area refiners for processing. The above costs are associated with transporting the bitumen to a rail logistics terminal in Port Arthur

[22] TransCanada Pipeline Operations Source.

(for example GT Logistics is developing such a facility). Port Arthur, a destination market for Keystone XL, has refining capacity capable of handling bitumen and has access by barge to these refineries as well as the Houston market. In order to move the bitumen to local refineries, an additional $0.60/bbl is included as a marine transportation cost to move the bitumen on heated barges (estimate by Poten and Partners, LLC). If, however, the bitumen is to be transported to Houston area refineries instead, an additional $1.42/bbl (a total of $2.02/bbl) would be required for the longer trip.[23]

It is slightly less costly to ship railbit by marine vessel than bitumen due to the fact that the railbit is a higher API gravity and more barrels can be transported. Consequently, the costs for moving railbit to the destination refineries are estimated at $0.57/bbl to Port Arthur and $1.92/bbl to Houston. Converting this to a per bitumen barrel estimated, these equate to $0.67/bbl and $2.26/bbl, respectively.

Transporting Diluent North

In order to procure the diluent in Alberta for blending with bitumen for transport to the USGC, the rail shippers can either purchase the diluent in Alberta, ship the diluent back north on the returning railcars from the USGC, or ship the diluent along the same pipeline route described in the pipeline section of this analysis. Assuming rail shippers opt for the latter option, the pipeline tariff costs would be the same at $8.2495/bbl of diluent. However, since less diluent is required in the railbit blend, the cost would be $1.46/bbl of bitumen.

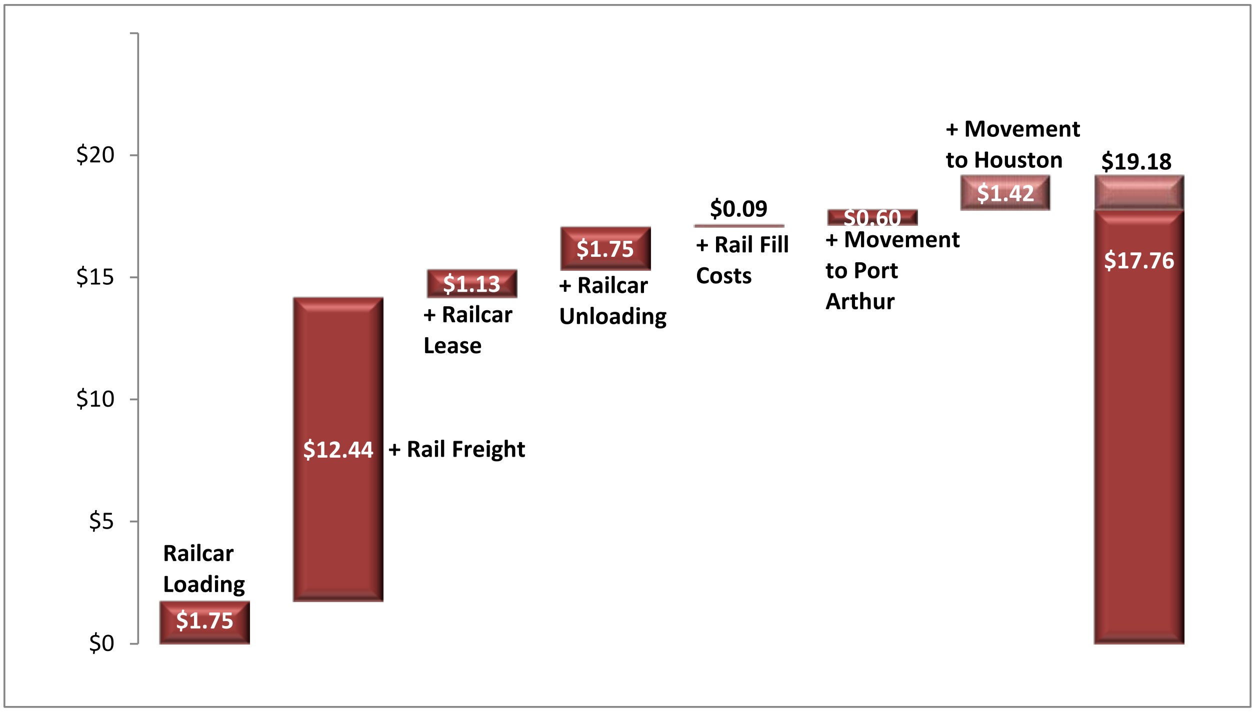
$$\frac{0.15\,\frac{bbl\ of\ diluent}{bbl\ of\ railbit} \times (\$8.2495)}{0.85\ \frac{bbl\ of\ bitumen}{bbl\ of\ railbit}} = US\$1.46\ per\ bbl\ bitumen$$

Rail Cost Summary

The rail costs discussed above for bitumen and railbit transport to the USGC are summarized in the figures below. The total buildup depending on destination refinery location for bitumen costs between $17.76/bbl of bitumen and $19.18/bbl of bitumen. Both options are relatively cost competitive with the committed rates in the pipeline analysis while minimizing commitment risk, and appear more competitive than the uncommitted pipeline rates. For railbit, the costs are higher due to the need for diluent. These costs are $21.69/bbl of bitumen and $23.27/bbl of bitumen depending on destination refinery location.

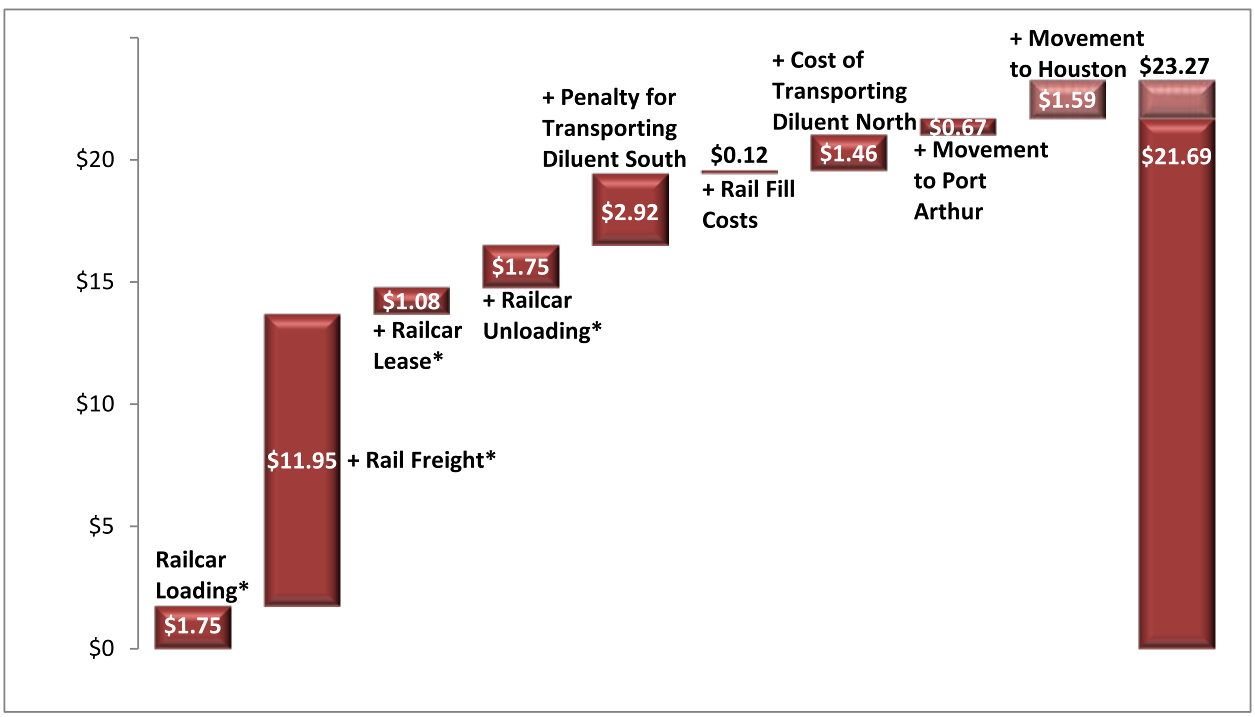
[23] It is possible that Houston area rail facilities may be developed to improve economic access to Houston refiners

Figure 2: Bitumen by Rail Economics (Western Canada to the USGC), US$/bbl of Bitumen



Note: costs may not sum due to independent rounding.

Figure 3: Railbit by Rail Economics (Western Canada to the USGC), US$/bbl of Bitumen (unless noted)



Note: costs may not sum due to independent rounding.
***Cost is shown in $ per railbit barrel.**

A variety of publicly available information has been put forth showing the rail cost of moving heavy Canadian crude to the USGC. Though this data varies, it encompasses the findings in this study. The following table summarizes a few of these studies. The studies below that show costs to transport blended bitumen do not appear to include the cost of providing the diluent and therefore may not be on a bitumen transport basis.

Table 1: Rail Costs for Heavy Crude Movement to the USGC

Source	Date	Cost (US$/bbl)	Crude Type
Devon Energy	July 2013	$14-$21	Heavy oil blend
PLG	July 2013	$23.50	WCS
Canadian Natural	June 2013	$20	Not specified
Raymond James via Canexus	May 2013	Manifest: $23.00 Unit: $20.50	Bitumen
Gibson Energy	March 2013	Manifest: $17-$21 Unit: $14-$17	Not specified
Southern Pacific via Reuters	November 2012	$31	Bitumen

Sources: Devon Investor Meeting. Slide 54. July 2013.
http://mwrailshippers.com/mars_pdfs/2013_brisben_presentation.pdf
http://www.cnrl.com/upload/media_element/631/03/2013-investor-open-house-binder_final.pdf
http://canexus.ca/documents/Canexus_AGM_2013.pdf
http://www.gibsons.com/Doc/Investor%20Presentation%20March%202013.pdf
http://www.reuters.com/article/2012/11/04/us-railways-oil-northamerica-idUSBRE8A30AX20121104

Conclusion

The following tables summarize and compare each transport option discussed previously.

Table 2: Breakdown of Pipeline Costs, US$/bbl Bitumen (unless noted)

Pipeline Step Cost	Committed Cost	Uncommitted Cost
Keystone Tariff to Cushing	$6.12*	$6.12*
Seaway Tariff to Refinery	$4.01*	$4.01*
Penalty for Transporting Diluent South	$4.34	$4.34
Line Fill Costs	$0.38	$0.38
Transporting the Diluent North	$3.54	$3.54
Uncommitted Pipeline Tariff Premium	N/A	$6.91
Total Long-Term Rate	**$18.38**	**$25.30**

Note: costs may not sum due to independent rounding.
Note: the uncommitted tariff as stated by the pipelines would be higher for Keystone and Seaway, but this added cost is separated in this analysis.
*Cost is shown in $ per dilbit barrel.

Note that using the full pass TransCanada tariff into Houston would lower than the total long-term committed rate from $18.38/bbl to $16.14/bbl due to a lower tariff and a lower penalty for transporting diluent south. Uncommitted rates would decline from $25.30/bbl to $24.78/bbl.

Table 3: Breakdown of Rail Costs by Blend, US$/bbl of Bitumen (unless noted)

Rail Step Cost	Bitumen Cost	Railbit Cost
Rail Loading	$1.75	$1.75*
Rail Freight	$12.44	$11.95*
Railcar Lease	$1.13	$1.08*
Rail Unloading	$1.75	$1.75*
Penalty for Transporting Diluent South	N/A	$2.92
Rail Fill	$0.09	$0.12
Transporting Diluent North	N/A	$1.46
Movement to Port Arthur / Houston	$0.60 / $2.02	$0.67 / $2.26
Total Rate	**$17.76 / $19.18**	**$21.69 / $23.27**

Note: costs may not sum due to independent rounding.
*Cost is shown in $ per railbit barrel.

ATTACHMENT 4, POTENTIAL RAIL LOGISTICS CONSTRAINTS FOR CRUDE OIL MOVEMENTS FROM CANADA TO U.S. DESTINATIONS, BY HELLERWORX

Potential Rail Logistics Constraints for Crude Oil Movements from Canada to US Destinations

A. Background

During the extended period that the Keystone XL Pipeline has been under consideration, increasingly larger volumes of crude oil have begun to move by rail to destinations throughout the US and Canada. The potential destinations for Canadian crude oil are on the US East Coast, West Coast and Gulf Coast as well as to the east and west coasts of Canada. The largest demand is likely in the US Gulf Coast. That region contains the largest number of refineries designed to process heavy crude oil such as Western Canadian Select that are produced in Canada.

B. Estimated Volume

1. Keystone XL

The planned volumes the proposed Keystone XL pipeline are about 830,000 barrels per day (730,000 barrels per day from Canada and 100,000 barrels per day from North Dakota). This equates to about 27-28 new trains per day with about four trains of Bakken crude originating in North Dakota and the balance a mix of dilbit, railbit and rawbit at originating at various places in Alberta and Saskatchewan in Canada. The table below estimates the number of trains per day represented by these volumes using dilbit as an example product. [1]

Barrels Per Car	597
Cars per train	100
Barrels per train	59,700
Loaded trains per day	13.90
Empty trains	13.90
Total trains per day	27.81

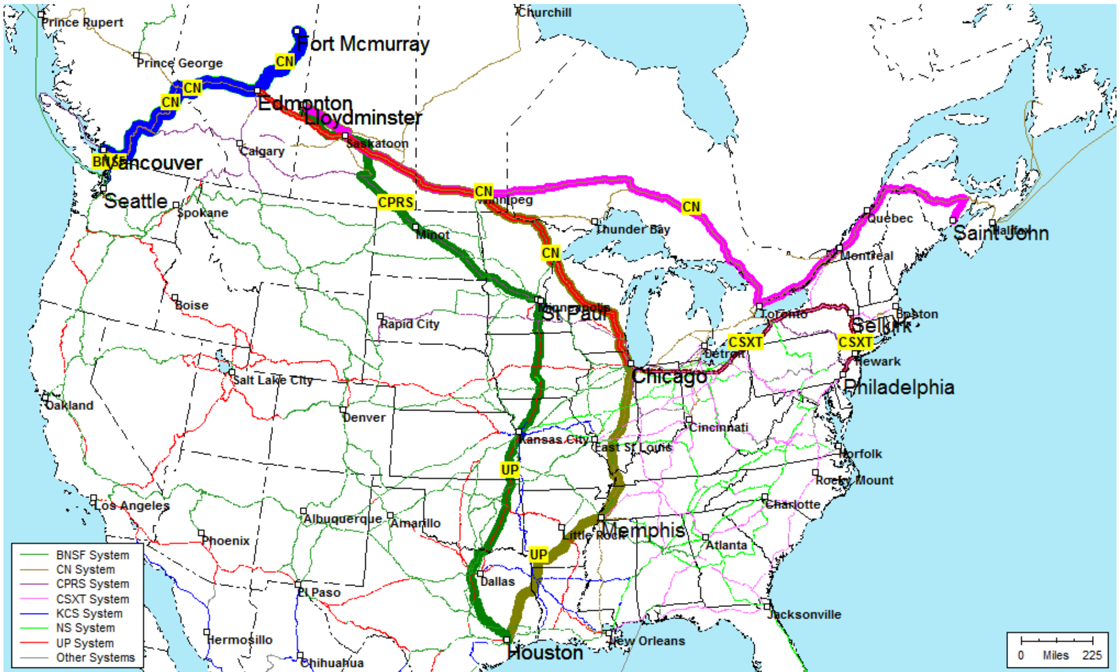
2. Constrained Pipelines Scenario

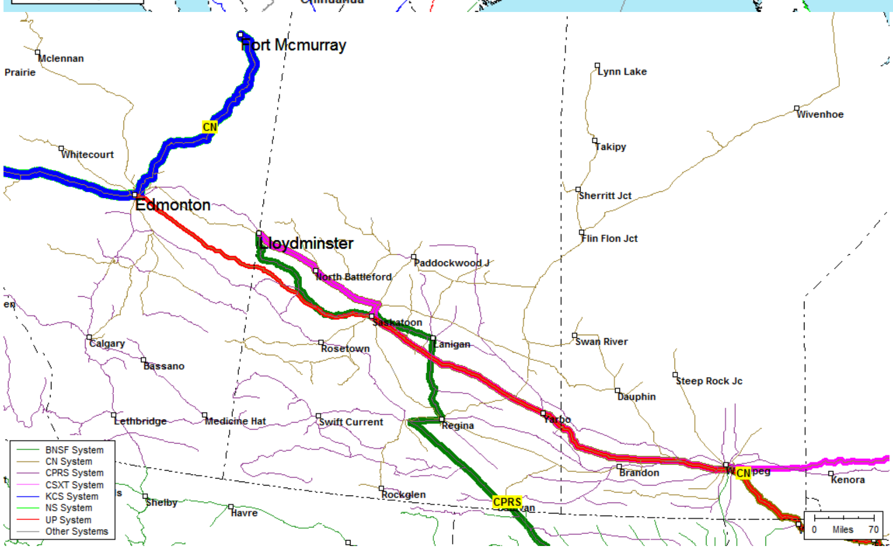
There are several proposed projects for new pipelines as well as reversals of direction and repurposing of existing pipelines. In addition to Keystone XL, the other pipelines would provide capacity to the east

[1] Dilbit is projected to move in general service tank cars. Railbit and rawbit are projected to move in coiled and insulated tank cars with higher tare weights. These products also weigh more per gallon than Dilbit so each railcar will hold fewer barrels. The equivalent additional trains per day would be 30.29 for railbit and 31.56 for raw bitumen.

and west coasts of Canada. If none of these projects are built, there could conceivably be demand for up to 4.5 million barrels per day of additional rail transportation. In a previous analysis, we indicated that demand would be spread among various destination areas. The volume and estimated number of trains per day under this scenario are shown in the table below by destination region. The total number of additional trains per day by destination region would vary between five and 35. But in total, 150 potential new trains per day would move on the existing rail network. As shown in the maps below, most of these trains would move over relatively small segments of the Canadian National (CN) and Canadian Pacific (CP) Railways. This concentration of potential new trains would exceed the existing capacity of the rail infrastructure in this part of Canada. A discussion of current capacity and the options for accommodating the growth in train volume are discussed in Sections C and D below.

Destination Area	**Projected Millions of b/d**	**Loaded Trains/Day**	**Empty Trains/Day**	**Total Trains/Day**
BC West Coast	760,000	12.73	12.73	25.46
US PNW	750,000	12.56	12.56	25.13
US California	570,000	9.55	9.55	19.10
US Gulf Coast - Other	1,040,000	17.42	17.42	34.84
Us Gulf Coast - Houston	850,000	14.24	14.24	28.48
US East Coast	150,000	2.51	2.51	5.03
Eastern Canada	380,000	6.37	6.37	12.73
Total	**4,500,000**	**75.38**	**75.38**	**150.75**





C. Railroad Capacity

Capacity on any given segment of railroad is determined by three key factors, the number of main tracks, the traffic control systems, and the train types. A 2007 Cambridge Systematics Study prepared for the Association of American Railroads describes each factor along with the potential capacity of each configuration.[2]

1. Number of main tracks

[2] Cambridge Systematics, Inc. National Freight Infrastructure Capacity and Investment Study, Prepared for the Association of American Railroads, September 2007, p 4-5 to 4-7.

Most of the route segments that would be utilized by crude oil trains from Canada have one main track with multiple sidings for trains to meet or pass. However, there are sections in the US with two or more main tracks.

2. Traffic Control Systems

Traffic control systems help maintain a safe distance between trains passing or meeting on the same track. There are three basic types:

a. **Traffic Warrant Control (TWC) or No Signals**

Under these basic control systems, train crews obtain permission or a warrant from the dispatcher to occupy a given piece of railroad. Usually this is done by phone, radio or electronic transmission to the locomotive. It is the least costly system and is generally used on low density track where capacity is generally not an issue.

b. Automatic Block Signals (ABS)

ABS is an electronic signal system that can control when a train can advance into the next block. A block is a section of track with signals at each end. Generally only one train can occupy a block at one time. The signals provide information to the train crew about speed; and they provide information about the occupancy of the blocks ahead. Trains can generally run faster and closer together than under TWC.

c. Centralized Traffic Control (CTC) and Traffic Control Systems (TCS)

With CTC electrical circuits monitor the location of trains allowing dispatchers to control train movements from a remote location, usually a central dispatching office. The signals automatically prevent trains from entering sections of track occupied by other trains. The signals can be controlled by the dispatcher allowing trains to operate closer together than under ABS, thus increasing capacity.

3. Train Types

Different train types such as passenger, intermodal, automotive, coal unit and general manifest trains operate at different speeds. The different train speeds require a larger separation on a route segment than if the segment were only occupied by trains of the same type. For the purpose of this analysis, multiple train types were assumed for the capacity analysis. The table below shows the estimated capacity based on number of main tracks and traffic control systems.

Table 4.2 Average Capacities of Typical Rail-Freight Corridors

Trains per Day

Number of Tracks	Type of Control	Trains per Day: Practical Maximum If Multiple Train Types Use Corridor*	Trains per Day: Practical Maximum If Single Train Type Uses Corridor**
1	N/S or TWC	16	20
1	ABS	18	25
2	N/S or TWC	28	35
1	CTC or TCS	30	48
2	ABS	53	80
2	CTC or TCS	75	100
3	CTC or TCS	133	163
4	CTC or TCS	173	230
5	CTC or TCS	248	340
6	CTC or TCS	360	415

Key: N/S-TWC – No Signal/Track Warrant Control.
ABS – Automatic Block Signaling.
CTC-TCS – Centralized Traffic Control/Traffic Control System.

Notes: * For example, a mix of merchandise, intermodal, and passenger trains.
** For example, all intermodal trains.

The table presents average capacities for typical rail freight corridors. The actual capacities of the corridors were estimated using railroad-specific capacity tables. At the request of the railroads, these detailed capacity tables were not included in this report to protect confidential railroad business information.

Source: Class I railroad data aggregated by Cambridge Systematics, Inc.

D. Railroad Investments Required to Move Potential Incremental Crude Oil Trains

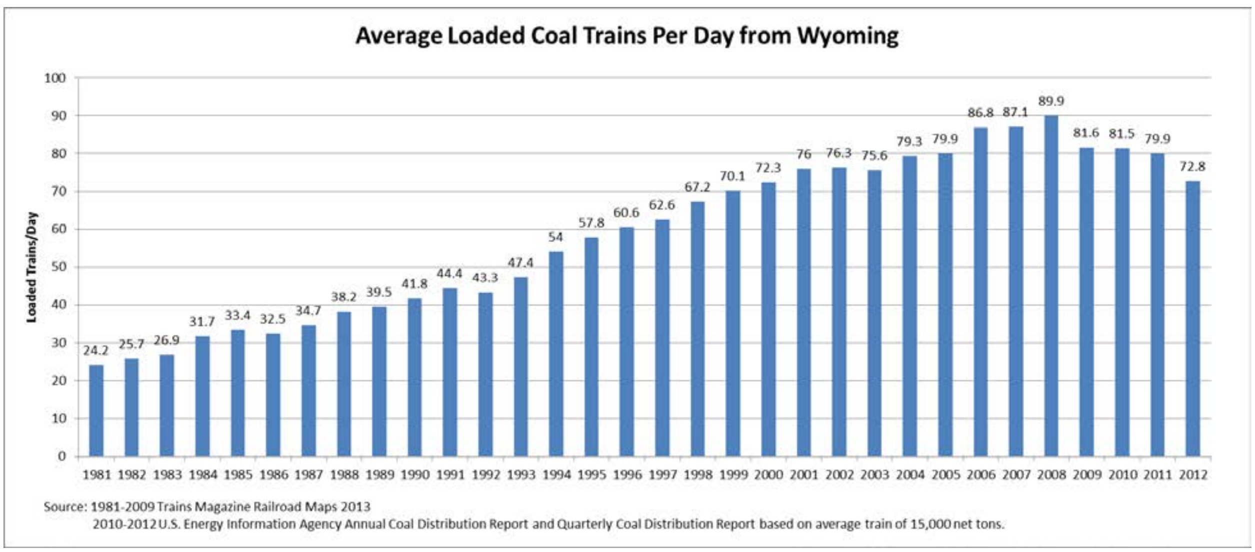
1. Keystone XL Volume

The most significant impacts of the additional crude oil volume on the North American rail system would be close to the origins in Alberta and Saskatchewan. If the planned Keystone XL barrels all move via rail, this would add about 14 loaded and 14 empty trains per day. Most of the railroad north of Edmonton on both CN and CP is single track with passing sidings and a variety of traffic control systems ranging from TWC to ABS with CTC systems located closer to Edmonton. Once capacity is reached the railroads would likely upgrade segments from TWC or ABS signal systems to CTC. This change should increase capacity on those segments by another 12 to 14 trains per day. Beyond this level, the railroads would then build second main tracks on the segments with the most congestion. This would add capacity for an additional 45 trains per day, more than enough to handle the additional crude oil trains. Each railroad would also invest in additional locomotives and hire train crews and other personnel as necessary.[3]

2. Constrained Pipelines Scenario

In the constrained pipelines scenario in which no new pipelines were built, potential demand for rail service could exceed 150 additional trains per day which would be split between Fort McMurray and Edmonton on CN and between Lloydminster and Edmonton or Winnipeg on both CN and CP. Several years of capital investment would be required for CP and CN to handle this additional volume. However, it is unlikely that all of the new production would come on stream at the same time. Therefore, the railroad would have time to plan for and make the required investments in additional track, traffic control systems, locomotives and other assets. Depending on the rate of increase in train volume there could be temporary capacity constraints; but the railroads would make investments to handle the projected volume.

There is precedent for railroads handling this rate of volume growth. In the Powder River Basin in Wyoming, BNSF and UP made the capital investments required to handle a four- fold increase in daily train volume. The track infrastructure in the region now includes a joint line with three and four main tracks.



South and west of Edmonton and east of Winnipeg the number of additional trains on any segment drops off considerably as trains head in five different directions to the US Gulf Coast, US East Coast, US

[3] Portions of the capital costs and return on investment for these items are included in the long run variable cost (LRVC) estimates for each example movement. Major upgrades to infrastructure such as traffic control systems and the addition of main line tracks would also add to the fixed cost for each railroad. Over the past three years all of the Class I railroads in the US and Canada have made similar investments in main line track, traffic control systems and locomotives to handle the projected growth in crude oil indicating that they anticipate earning a return sufficient to justify these investments.

West Coast, Eastern Canada and Vancouver/Prince Rupert, BC. There are multiple railroads and rail routes to all of these regions so the impact on any one line would be relatively small.

Railroads are constantly planning for growth in volume and staging capital investments where they anticipate the next level of growth. They would presumably consider the potential additional crude oil volume along with growth in other traffic to plan investment in additional track, traffic control technology, locomotives and other assets. Railroads have also established cooperative arrangements for trackage rights and joint operations when it is viewed as advantageous. An example of such an arrangement is the CP and CN directional running agreement along the Fraser River Valley between Boston Bar and Mission/Coho, BC on the route to Vancouver, BC. Over this section, westbound trains of both railroads move over CN track and eastbound trains move over CP.

E. US – Canada Border Crossing Infrastructure

The key border crossing points into the US are likely to be Blaine, WA, Portal, ND and International Falls, MN. There are several smaller border crossings at Sumas, WA, Eastport, ID, and Noyes, ND. All of the border crossing locations have one main track crossing the border. At several locations there are also sidings that cross the border. The table below shows the number of tracks crossing the border. As with other track infrastructure, tracks can and would be added as required by the railroads if the volume of traffic warrants the investment. CP has already done this at Portal, ND where the traffic control system is being upgraded from TWC to CTC in order to increase capacity.

Border Crossing Infrastructure

Blaine, WA	1 track across border
Sumas, WA	2 tracks across border
Eastport, ID	2 tracks across border
Sweetgrass, MT	2 tracks across border
Portal, ND	2 tracks across border
Noyes, ND	1 track across border
International Falls, MN	1 track across border

ATTACHMENT 5,
OIL SANDS DEVELOPMENT GROUP: OIL SANDS PROJECT LIST

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Oil Sands Project List - Updated July 1, 2013
Source: Oil Sands Review Magazine, Junewarren-nickle's energy group

	Project Names	Location	Status	Est. Bitumen Production Capacity bpd	Est. Start of Production	Estimated Capex $M
MINING PROJECTS						
Canadian Natural Resources Ltd.	Horizon Phase 1	Athabasca North	Operating	135,000	2008	N/A
Canadian Natural Resources Ltd.	Horizon Phase 2A	Athabasca North	Construction	10,000	2015	N/A
Canadian Natural Resources Ltd.	Horizon Phase 2B	Athabasca North	Construction	45,000	2016	N/A
Canadian Natural Resources Ltd.	Horizon Phase 3	Athabasca North	Construction	80,000	2017	N/A
Canadian Natural Resources Ltd.	Tranche 2	Athabasca North	Operating	5,000	2012	N/A
Imperial Oil Ltd	Kearl Phase 1	Athabasca North	Operating	110,000	2013	N/A
Imperial Oil Ltd	Kearl Phase 2	Athabasca North	Construction	110,000	2015	N/A
Imperial Oil Ltd	Kearl Phase 3 Debottleneck	Athabasca North	Approved	70,000	2020	N/A
Shell Albian Sands	Jackpine Expansion	Athabasca North	Application	100,000	2017	N/A
Shell Albian Sands	Jackpine Phase 1A	Athabasca North	Operating	100,000	2010	N/A
Shell Albian Sands	Jackpine Phase 1B	Athabasca North	Approved	100,000	TBD	N/A
Shell Albian Sands	Muskeg River Commercial	Athabasca North	Operating	155,000	2002	N/A
Shell Albian Sands	Muskeg River Expansion & Debottleneking	Athabasca North	Approved	115,000	TBD	N/A
Shell Albian Sands	Pierre River Phase 1	Athabasca North	Application	100,000	2018	N/A
Shell Albian Sands	Pierre River Phase 2	Athabasca North	Application	100,000	TBD	N/A
Suncor Energy Inc.	Base Operations Millennium Debottlenecking	Athabasca North	Operating	23,000	2008	N/A
Suncor Energy Inc.	Base Operations Millennium Mine	Athabasca North	Operating	294,000	1967	N/A
Suncor Energy Inc.	Base Operations North Steepbank Extension	Athabasca North	Operating	180,000	2012	N/A
Suncor Energy Inc.	Base Operations Steepbank Debottleneck Phase 3	Athabasca North	Operating	4,000	2007	N/A
Suncor Energy Inc.	Fort Hills Debottleneck	Athabasca North	Approved	25,000	TBD	N/A
Suncor Energy Inc.	Fort Hills Phase 1	Athabasca North	Approved	165,000	2017	N/A
Suncor Energy Inc.	Voyageur South Phase 1	Athabasca North	Application	120,000	TBD	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora North & South Aurora South Train 1	Athabasca North	Construction	100,000	2016	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora North & South Aurora South Train 2	Athabasca North	Approved	100,000	2018	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora North & South Base Mine Stage 1 & 2 Expansion	Athabasca North	Operating	290,700	1978	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora North & South Stage 3 Expansion	Athabasca North	Operating	116,300	2006	N/A
Teck Recources Ltd.	Frontier Phase 1	Athabasca North	Application	74,600	2021	N/A
Teck Recources Ltd.	Frontier Phase 2	Athabasca North	Application	84,000	2024	N/A
Teck Recources Ltd.	Frontier Phase 3	Athabasca North	Application	79,300	2027	N/A
Teck Recources Ltd.	Frontier Phase 4 Equinox	Athabasca North	Application	39,400	2030	N/A
Total E&P Canada	Joslyn North Mine Phase 1	Athabasca North	Approved	100,000	2018	N/A

IN-SITU PROJECTS						
Alberta Oilsands Inc.	Clearwater West Phase 2	Athabasca South	Announced	25,000	2016	N/A
Alberta Oilsands Inc.	Clearwater Phase 1 Pilot	Athabasca South	Application	4,350	TBD	N/A
Andora Energy Corporation	Sawn Lake SAGD Demonstration	Peace River	Approved	1,400	2014	N/A
Athabasca Oil Sands Corp.	Birch Phase 1	Athabasca North	Announced	12,000	TBD	N/A
Athabasca Oil Sands Corp.	Dover West Sands & Clasrics Phase 1	Athabasca North	Application	12,000	2015	N/A
Athabasca Oil Sands Corp.	Dover West Sands & Clasrics Phase 2	Athabasca North	Announced	35,000	2018	N/A
Athabasca Oil Sands Corp.	Dover West Sands & Clastics Phase 3	Athabasca North	Announced	35,000	2020	N/A
Athabasca Oil Sands Corp.	Dover West Sands & Clastics Phase 4	Athabasca North	Announced	35,000	2022	N/A
Athabasca Oil Sands Corp.	Dover West Sands & Clastics Phase 5	Athabasca North	Announced	35,000	2024	N/A
Athabasca Oil Sands Corp.	Dover West Leduc Carbonates Phase 1 Demonstration	Athabasca North	Application	6,000	2015	N/A
Athabasca Oil Sands Corp.	Dover West Leduc Carbonates Phase 2 Demonstration	Athabasca North	Application	6,000	TBD	N/A
Athabasca Oil Sands Corp.	Hangingstone Phase 1	Athabasca South	Construction	12,000	2014	N/A
Athabasca Oil Sands Corp.	Hangingstone Phase 2	Athabasca South	Announced	35,000	2017	N/A
Athabasca Oil Sands Corp.	Hangingstone Phase 3	Athabasca South	Announced	35,000	2019	N/A
BlackPearl Resources Inc.	Blackrod Phase 1	Athabasca South	Application	20,000	2015	N/A
BlackPearl Resources Inc.	Blackrod Phase 2	Athabasca South	Application	30,000	2018	N/A

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BlackPearl Resources Inc.	Blackrod Phase 3	Athabasca South	Application	30,000	2021	N/A
BlackPearl Resources Inc.	Blackrod Pilot	Athabasca South	Operating	800	2011	N/A
Birchwood Resources Ltd.	Sage Pilot	Cold Lake Region	Application	5,000	2015	N/A
B.P p.l.c	Terre de Grace Pilot	Athabasca North	Approved	10,000	TBD	N/A
Baytex Energy Corp.	Gemini Pilot	Cold Lake	Approved	1,200	TBD	N/A
Baytex Energy Corp.	Gemini Commercial	Cold Lake	Approved	5,000	2016	N/A
Baytex Energy Corp.	Cliffdale Pilot	Peace River	Operating	2,000	2010	N/A
Baytex Energy Corp.	Harmon Valley Pilot	Peace River	Operating	TBD	2011	N/A
Canadian Natural Resources Ltd.	Birch Mountain Phase 1	Athabasca North	Announced	60,000	2019	N/A
Canadian Natural Resources Ltd.	Birch Mountain Phase 2	Athabasca North	Announced	60,000	2023	N/A
Canadian Natural Resources Ltd.	Gregoire Lake Phase 1	Athabasca South	Announced	60,000	TBD	N/A
Canadian Natural Resources Ltd.	Gregoire Lake Phase 2	Athabasca South	Announced	60,000	TBD	N/A
Canadian Natural Resources Ltd.	Grouse Commercial	Athabasca South	Application	50,000	TBD	N/A
Canadian Natural Resources Ltd.	Kirby (North) Phase 1	Athabasca South	Application	40,000	2016	N/A
Canadian Natural Resources Ltd.	Kirby (North) Phase 2	Athabasca South	Application	60,000	2023	N/A
Canadian Natural Resources Ltd.	Kirby (South) Phase 1	Athabasca South	Construction	40,000	2013	N/A
Canadian Natural Resources Ltd.	Kirby (South) Phase 2	Athabasca South	Application	20,000	2020	N/A
Canadian Natural Resources Ltd.	Primrose East	Cold Lake	Operating	32,000	2008	N/A
Canadian Natural Resources Ltd.	Primrose North	Cold Lake	Operating	30,000	2006	N/A
Canadian Natural Resources Ltd.	Primrose South	Cold Lake	Operating	45,000	1985	N/A
Canadian Natural Resources Ltd.	Wolf Lake	Cold Lake	Operating	13,000	1985	N/A
Cavalier Energy Inc.	Hoole Phase 1	Athbasca South	Application	10,000	2017	N/A
Cavalier Energy Inc.	Hoole Phase 2	Athbasca South	Announced	35,000	TBD	N/A
Cavalier Energy Inc.	Hoole Phase 3	Athbasca South	Announced	35,000	TBD	N/A
Cenovus Energy Inc.	Telephone Lake Borealis Phase A	Athabasca North	Application	45,000	TBD	N/A
Cenovus Energy Inc.	Telephone Lake Borealis Phase B	Athabasca North	Application	45,000	TBD	N/A
Cenovus Energy Inc.	East McMurray Phase 1	Athabasca North	Announced	30,000	TBD	N/A
Cenovus Energy Inc.	Steepbank Phase 1	Athabasca North	Announced	30,000	TBD	N/A
Cenovus Energy Inc.	Future Optimization	Athabasca South	Announced	12,000	TBD	N/A
Cenovus Energy Inc.	Christina Lake Phase 1A	Athabasca South	Operating	10,000	2002	N/A
Cenovus Energy Inc.	Christina Lake Phase 1B	Athabasca South	Operating	8,800	2008	N/A
Cenovus Energy Inc.	Christina Lake Phase C	Athabasca South	Operating	40,000	2011	N/A
Cenovus Energy Inc.	Christina Lake Phase D	Athabasca South	Operating	40,000	2012	N/A
Cenovus Energy Inc.	Christina Lake Phase E	Athabasca South	Construction	40,000	2013	N/A
Cenovus Energy Inc.	Christina Lake Phase F	Athabasca South	Construction	50,000	2016	N/A
Cenovus Energy Inc.	Christina Lake Phase G	Athabasca South	Approved	50,000	2017	N/A
Cenovus Energy Inc.	Christina Lake Phase H	Athabasca South	Application	50,000	2019	N/A
Cenovus Energy Inc.	Future Optimization	Athabasca South	Announced	15,000	TBD	N/A
Cenovus Energy Inc.	Foster Creek Phase A	Athabasca South	Operating	24,000	2001	N/A
Cenovus Energy Inc.	Foster Creek Phase B Debottleneck	Athabasca South	Operating	6,000	2003	N/A
Cenovus Energy Inc.	Foster Creek Phase C Stage 1	Athabasca South	Operating	10,000	2005	N/A
Cenovus Energy Inc.	Foster Creek Phase C Stage 2	Athabasca South	Operating	20,000	2007	N/A
Cenovus Energy Inc.	Foster Creek Phase D	Athabasca South	Operating	30,000	2009	N/A
Cenovus Energy Inc.	Foster Creek Phase E	Athabasca South	Operating	30,000	2009	N/A
Cenovus Energy Inc.	Foster Creek Phase F	Athabasca South	Construction	45,000	2014	N/A
Cenovus Energy Inc.	Foster Creek Phase G	Athabasca South	Approved	40,000	2015	N/A
Cenovus Energy Inc.	Foster Creek Phase H	Athabasca South	Approved	40,000	2016	N/A
Cenovus Energy Inc.	Foster Creek Phase J	Athabasca South	Application	50,000	2019	N/A
Cenovus Energy Inc.	Narrows Lake Phase 1	Athabasca South	Construction	45,000	2017	N/A
Cenovus Energy Inc.	Narrows Lake Phase 2	Athabasca South	Approved	45,000	TBD	N/A
Cenovus Energy Inc.	Narrows Lake Phase 3	Athabasca South	Approved	40,000	TBD	N/A
Cenovus Energy Inc.	Pelican Lake Grand Rapids Phase A	Athabasca South	Application	60,000	2017	N/A
Cenovus Energy Inc.	Pelican Lake Grand Rapids Phase B	Athabasca South	Application	60,000	TBD	N/A
Cenovus Energy Inc.	Pelican Lake Grand Rapids Phase C	Athabasca South	Application	60,000	TBD	N/A
Cenovus Energy Inc.	Pelican Lake Grand Rapids Pilot	Athabasca South	Operating	600	2011	N/A

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Cenovus Energy Inc.	West Kirby Phase 1	Athabasca South	Announced	30,000	TBD	N/A
Cenovus Energy Inc.	Winefred Lake Phase 1	Athabasca South	Announced	30,000	TBD	N/A
Cenovus Energy Inc.	Axe Lake Commercial	Saskatchewan Region	On Hold	30,000	TBD	N/A
Connacher Oil and Gas Limited	Algar	Athabasca South	Operating	10,000	2010	N/A
Connacher Oil and Gas Limited	Great Divide Expansion 1A	Athabasca South	Approved	12,000	TBD	N/A
Connacher Oil and Gas Limited	Great Divide Expansion 1B	Athabasca South	Approved	12,000	TBD	N/A
Connacher Oil and Gas Limited	Great Divide Pod 1	Athabasca South	Operating	10,000	2007	N/A
ConocoPhillips Canada Limited	Surmot Phase 1	Athabasca South	Operating	27,000	2007	N/A
ConocoPhillips Canada Limited	Surmont Phase 2	Athabasca South	Construction	109,000	2015	N/A
ConocoPhillips Canada Limited	Surmont Pilot	Athabasca South	Operating	1,200	1997	N/A
Devon Canada Corporation	Jackfish Phase 1	Athabasca South	Operating	35,000	2007	N/A
Devon Canada Corporation	Jackfish Phase 2	Athabasca South	Operating	35,000	2011	N/A
Devon Canada Corporation	Jackfish Phase 3	Athabasca South	Construction	35,000	2015	N/A
Devon Canada Corporation	Jackfish East Expansion	Athabasca South	Announced	20,000	2018	N/A
Devon Canada Corporation	Pike 1A	Athabasca South	Application	35,000	2016	N/A
Devon Canada Corporation	Pike 1B	Athabasca South	Application	35,000	2017	N/A
Devon Canada Corporation	Pike 1C	Athabasca South	Application	35,000	2018	N/A
Devon Canada Corporation	Walleye Phase 1	Cold Lake Region	Application	9,000	2017	N/A
Dover Operating Corp.	Dover Phase 1	Athabasca North	Application	50,000	2016	N/A
Dover Operating Corp.	Dover North Phase 2	Athabasca North	Application	50,000	2018	N/A
Dover Operating Corp.	Dover South Phase 3	Athabasca North	Application	50,000	2020	N/A
Dover Operating Corp.	Dover South Phase 4	Athabasca North	Application	50,000	2022	N/A
Dover Operating Corp.	Dover South Phase 5	Athabasca North	Application	50,000	2024	N/A
Dover Operating Corp.	MacKay River Phase 1	Athabasca North	Construction	35,000	2014	N/A
Dover Operating Corp.	MacKay River Phase 2	Athabasca North	Approved	40,000	2017	N/A
Dover Operating Corp.	MacKay River Phase 3	Athabasca North	Approved	40,000	2019	N/A
Dover Operating Corp.	MacKay River Phase 4	Athabasca North	Approved	35,000	TBD	N/A
E-T Energy Ltd.	Poplar Creek Phase 1	Athabasca North	Announced	10,000	TBD	N/A
E-T Energy Ltd.	Poplar Creek Phase 2	Athabasca North	Announced	40,000	TBD	N/A
E-T Energy Ltd.	Poplar Creek experimental pilot	Athabasca North	Operating	1,000	2007	N/A
Grizzly Oil Sands Ulc	Thickwood Phase 1	Athabasca North	Application	6,000	2017	N/A
Grizzly Oil Sands Ulc	Thickwood Phase 2	Athabasca North	Application	6,000	TBD	N/A
Grizzly Oil Sands Ulc	Algar Lake Phase 1	Athabasca South	Construction	5,500	2013	N/A
Grizzly Oil Sands Ulc	Algar Lake Phase 2	Athabasca South	Approved	5,500	2014	N/A
Grizzly Oil Sands Ulc	May River Phase 1	Athabasca South	Announced	6,800	TBD	N/A
Grizzly Oil Sands Ulc	May River Phase 2	Athabasca South	Announced	6,800	TBD	N/A
Harvest Operations Corp.	BlackGold Phase 1	Athabasca South	Construction	10,000	2014	N/A
Harvest Operations Corp.	BlackGold Phase 2	Athabasca South	Application	20,000	TBD	N/A
Husky Energy Inc.	Sunrise Phase 1	Athabasca North	Construction	60,000	2014	N/A
Husky Energy Inc.	Sunrise Phase 2	Athabasca North	Approved	50,000	2016	N/A
Husky Energy Inc.	Sunrise Phase 3	Athabasca North	Approved	50,000	2019	N/A
Husky Energy Inc.	Sunrise Phase 4	Athabasca North	Approved	50,000	TBD	N/A
Husky Energy Inc.	Saleski Carbonate pilot	Athabasca North	Application	3,000	2017	N/A
Husky Energy Inc.	McMullen Air Injection Pilot Experimental	Athabasca South	Operating	755	2012	N/A
Husky Energy Inc.	Caribou Demonstration	Cold Lake	Approved	10,000	TBD	N/A
Husky Energy Inc.	Tucker Phase 1	Cold Lake	Operating	30,000	2006	N/A
Imperial Oil Limited	Cold Lake Phase 1-10	Cold Lake	Operating	110,000	1985	N/A
Imperial Oil Limited	Cold Lake Phase 11-13	Cold Lake	Operating	30,000	2002	N/A
Imperial Oil Limited	Cold Lake Phase 14-16	Cold Lake	Construction	40,000	2014	N/A
Imperial Oil Limited	Aspen Phase 1	Athabasca North	Announced	40,000	TBD	N/A

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Ivanhoe Energy Inc.	Tamarack Phase 1	Athabasca North	Application	20,000	2016	N/A
Ivanhoe Energy Inc.	Tamarack Phase 2	Athabasca North	Application	20,000	TBD	N/A
Japan Canada Oil Sands Limited	Hangingstone Expansion	Athabasca South	Approved	20,000	2016	N/A
Japan Canada Oil Sands Limited	Hangingstone Pilot	Athabasca South	Operating	11,000	1999	N/A
Koch Exploration Canada Corp	Muskwa Pilot	Athabasca South	Application	10,000	2015	N/A
Laricina Energy Ltd.	Germain Phase 1 Commercial Demonstration	Athabasca South	Construction	5,000	2013	N/A
Laricina Energy Ltd.	Germain Phase 2	Athabasca South	Application	30,000	2016	N/A
Laricina Energy Ltd.	Germain Phase 3	Athabasca South	Application	60,000	TBD	N/A
Laricina Energy Ltd.	Germain Phase 4	Athabasca South	Application	60,000	TBD	N/A
Laricina Energy Ltd.	Saleski Phase 1	Athabasca South	Application	10,700	2015	N/A
Laricina Energy Ltd.	Saleski Experimental Pilot	Athabasca South	Operating	1,800	2011	N/A
Marathon Oil Corporation	Birchwood demonstration	Athabasca North	Application	12,000	2017	N/A
MEG Energy	Christina Lake Phase 1 Pilot	Athabasca South	Operating	3,000	2008	N/A
MEG Energy	Christina Lake Phase 2A	Athabasca South	Operating	22,000	2009	N/A
MEG Energy	Christina Lake Phase 2B	Athabasca South	Construction	35,000	2013	N/A
MEG Energy	Christina Lake Phase 3A	Athabasca South	Approved	50,000	2016	N/A
MEG Energy	Christina Lake Phase 3B	Athabasca South	Approved	50,000	2018	N/A
MEG Energy	Christina Lake Phase 3C	Athabasca South	Approved	50,000	2020	N/A
MEG Energy	Surmont Phase 1	Athabasca South	Application	41,000	2018	N/A
MEG Energy	Surmont Phase 2	Athabasca South	Application	41,000	TBD	N/A
MEG Energy	Surmont Phase 3	Athabasca South	Application	41,000	TBD	N/A
Murphy Oil Company Ltd.	Cadotte Pilot	Peace River	On Hold	TBD	TBD	N/A
Murphy Oil Company Ltd.	Seal/Cadotte	Peace River	Operating	TBD	2012	N/A
Nexen Inc.	Long Lake South (Kinosis) Phase 1	Athabasca South	Approved	40,000	TBD	N/A
Nexen Inc.	Long Lake South (Kinosis) Phase 2	Athabasca South	Approved	40,000	TBD	N/A
Nexen Inc.	Long Lake Phase 1	Athabasca South	Operating	72,000	2008	N/A
Nexen Inc.	Long Lake Phase 2	Athabasca South	Approved	72,000	TBD	N/A
Nexen Inc.	Long Lake Phase 3	Athabasca South	Application	72,000	TBD	N/A
Nexen Inc.	Long Lake Phase 4	Athabasca South	Announced	72,000	TBD	N/A
Northern Alberta Oil Ltd.	Swan Lake CSS Pilot	Peace River	Approved	700	TBD	N/A
Oak Point Energy Ltd.	Lewis Pilot	Athabasca North	Approved	1,720	TBD	N/A
OSUM Oil Sands Corp.	Sepiko Kesik Phase 1	Athabasca South	Application	30,000	2018	N/A
OSUM Oil Sands Corp.	Sepiko Kesik Phase 2	Athabasca South	Application	30,000	2020	N/A
OSUM Oil Sands Corp.	Taiga Phase 1	Cold Lake	Approved	23,000	2015	N/A
OSUM Oil Sands Corp.	Taiga Phase 2	Cold Lake	Approved	22,000	2017	N/A
Pengrowth Energy Corporation	Lindbergh Phase 1	Cold Lake	Application	12,500	2015	N/A
Pengrowth Energy Corporation	Lindbergh Phase 2	Cold Lake	Announced	17,500	2017	N/A
Pengrowth Energy Corporation	Lindbergh Phase 3	Cold Lake	Announced	20,000	2018	N/A
Pengrowth Energy Corporation	Lindbergh Pilot	Cold Lake	Operating	1,200	2012	N/A
Penn West Petroleum Ltd.	Harmon Valley South Pilot	Peace River	Construction	TBD	TBD	N/A
Penn West Petroleum Ltd.	Seal Main Commercial	Peace River	Application	10,000	2015	N/A
Penn West Petroleum Ltd.	Seal Main Pilot	Peace River	Operating	75	2011	N/A
Petrobank Energy & Resources Ltd.	Dawson Phase 2	Peace River	Announced	10,000	TBD	N/A
Petrobank Energy & Resources Ltd.	Dawson THAI Demonstration Experimental	Peace River	Construction	10,000	2013	N/A
Royal Dutch Shell plc	Cadotte Lake	Peace River	Operating	12,500	1986	N/A
Royal Dutch Shell plc	Carmon Creek Phase 1	Peace River	Approved	40,000	2015	N/A
Royal Dutch Shell plc	Carmon Creek Phase 2	Peace River	Approved	40,000	2018	N/A
Royal Dutch Shell plc	Orion Phase 1	Cold Lake	Operating	10,000	2007	N/A
Royal Dutch Shell plc	Orion Phase 2	Cold Lake	Approved	10,000	TBD	N/A
SilverWillow Energy Corporation	Audet Pilot	Athabasca North	Announced	12,000	2016	N/A

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Southern Pacific Resource Corp.	STP McKay Project Phase 1	Athabasca North	Operating	12,000	2012	N/A
Southern Pacific Resource Corp.	STP McKay Project Phase 1 Expansion	Athabasca North	Application	6,000	2015	N/A
Southern Pacific Resource Corp.	STP McKay Project Phase 2A	Athabasca North	Application	12,000	2017	N/A
Southern Pacific Resource Corp.	STP McKay Project phase 2B	Athabasca North	Application	6,000	2017	N/A
Southern Pacific Resource Corp.	Red Earth Commercial	Peace River	Announced	10,000	TBD	N/A
Southern Pacific Resource Corp.	Red Earth Pilot	Peace River	On Hold	1,000	2009	N/A
Southern Pacific Resource Corp.	Red Earth Pilot Expansion	Peace River	Announced	3,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Corner	Athabasca South	Approved	40,000	2017	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Corner Expansion	Athabasca South	Application	40,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Hangingstone	Athabasca South	Application	20,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Leismer Commercial	Athabasca South	Approved	10,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Leismer Demonstration	Athabasca South	Operating	10,000	2010	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Leismer Expansion	Athabasca South	Approved	20,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Leismer Northwest	Athabasca South	Application	20,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Leismer South	Athabasca South	Application	20,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Thornbury	Athabasca South	Application	40,000	TBD	N/A
Statoil Canada Ltd.	Kai Kos Dehseh Thornbury Expansion	Athabasca South	Application	20,000	TBD	N/A
Suncor Energy Inc.	Dover Demonstration Plant	Athabasca North	Construction	500	2013	N/A
Suncor Energy Inc.	Firebag Cogeneration and Expansion	Athabasca North	Operating	25,000	2007	N/A
Suncor Energy Inc.	Firebage Stage 1	Athabasca North	Operating	35,000	2004	N/A
Suncor Energy Inc.	Firebage Stage 2	Athabasca North	Operating	35,000	2006	N/A
Suncor Energy Inc.	Firebage Stage 3	Athabasca North	Operating	42,500	2011	N/A
Suncor Energy Inc.	Firebag Stage 3-6 Debottleneck	Athabasca North	Application	23,000	TBD	N/A
Suncor Energy Inc.	Firebage Stage 4	Athabasca North	Operating	42,500	2012	N/A
Suncor Energy Inc.	Firebage Stage 5	Athabasca North	Approved	62,500	2018	N/A
Suncor Energy Inc.	Firebage Stage 6	Athabasca North	Approved	62,500	2019	N/A
Suncor Energy Inc.	Lewis Phase1	Athabasca North	Announced	40,000	TBD	N/A
Suncor Energy Inc.	Lewis Phase 2	Athabasca North	Announced	40,000	TBD	N/A
Suncor Energy Inc.	MacKay River MR2	Athabasca North	Application	40,000	2016	N/A
Suncor Energy Inc.	MacKay River Phase 1	Athabasca North	Operating	33,000	2002	N/A
Suncor Energy Inc.	Chard Phase 1	Athabasca South	Announced	40,000	TBD	N/A
Suncor Energy Inc.	Meadow Creek Phase 1	Athabasca South	Approved	40,000	TBD	N/A
Suncor Energy Inc.	Meadow Creek Phase 2	Athabasca South	Approved	40,000	TBD	N/A
Surmont Energy Ltd.	Wildwood Phase 1	Athabasca South	Application	12000	2015	N/A
Sunshine Oil Sands	Harper Carbonate Pilot	Athabasca North	Operating	1,000	TBD	N/A
Sunshine Oil Sands	Legend Lake Phase A1	Athabasca North	Application	10,000	2016	N/A
Sunshine Oil Sands	Legend Lake Phase A2	Athabasca North	Announced	30,000	TBD	N/A
Sunshine Oil Sands	Legend Lake Phase B1	Athabasca North	Announced	30,000	TBD	N/A
Sunshine Oil Sands	Legend Lake Phase B2	Athabasca North	Announced	30,000	TBD	N/A
Sunshine Oil Sands	Thickwood Phase A1	Athabasca North	Application	10,000	2015	N/A
Sunshine Oil Sands	Thickwood Phase A2	Athabasca North	Announced	30,000	2018	N/A
Sunshine Oil Sands	Thickwood Phase B1	Athabasca North	Announced	30,000	2021	N/A
Sunshine Oil Sands	West Ells A Phase 1	Athabasca North	Construction	5,000	2013	N/A
Sunshine Oil Sands	West Ells A Phase 2	Athabasca North	Approved	5,000	2014	N/A
Sunshine Oil Sands	West Ells A Phase 3	Athabasca North	Announced	30,000	2018	N/A
Sunshine Oil Sands	West Ells B Phase 1	Athabasca North	Announced	20,000	2025	N/A
Sunshine Oil Sands	West Ells C Phase 2	Athabasca North	Announced	30,000	TBD	N/A
Sunshine Oil Sands	West Ells C Phase 1	Athabasca North	Announced	30,000	TBD	N/A
Value Creation Inc.	Advanced Tristar ATS-1	Athabasca South	Application	15,000	2016	N/A
Value Creation Inc.	Advanced Tristar ATS-2	Athabasca South	Application	30,000	2018	N/A
Value Creation Inc.	Advanced Tristar ATS-3	Athabasca South	Application	30,000	2020	N/A
Value Creation Inc.	Tristar Pilot	Athabasca South	Application	1,000	2014	N/A

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UPGRADER PROJECTS	**Project Names**	**Location**	**Status**	**Est. Bitumen Production Capacity bpd**	**Est. Start of Production**	**Est. Capex $M**
BP p.l.c	Terre de Grace Pilot	Athabasca North	Approved	8,400	TBD	N/A
Canadian Natural Resources Ltd.	Horizon Phase 1	Athabasca North	Operating	114,000	2019	N/A
Canadian Natural Resources Ltd.	Horizon Tranche 2	Athabasca North	Operating	5,000	2023	N/A
Canadian Natural Resources Ltd.	Horizon Phase 2A	Athabasca North	Construction	10,000	TBD	N/A
Canadian Natural Resources Ltd.	Horizon Phase 2B	Athabasca North	Construction	45,000	TBD	N/A
Canadian Natural Resources Ltd.	Horizon Phase 3	Athabasca North	Construction	80,000	TBD	N/A
Ivanhoe Energy Inc.	Tamarack Phase 1	Athabasca North	Application	34,784	2016	N/A
Suncor Energy Inc.	Base Operations U1 and U2	Athabasca North	Operating	225,000	1967	N/A
Suncor Energy Inc.	Millennium Vacuum Unit	Athabasca North	Operating	35,000	2005	N/A
Suncor Energy Inc.	Millennium Coker Unit	Athabasca North	Operating	97,000	2008	N/A
Suncor Energy Inc.	Voyageur Upgrader 3 Phase 1	Athabasca North	Cancelled	127,000	2016	N/A
Suncor Energy Inc.	Voyageur Upgrader 3 Phase 2	Athabasca North	Cancelled	63,000	TBD	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora Base Plant Stage 1&2 Debottleneck	Athabasca North	Operating	250,000	1978	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora Stage 3 Expansion (UE-1)	Athabasca North	Operating	10,000	2006	N/A
Syncrude Canada Ltd.	Mildred Lake/Aurora Stage 3 Debottleneck	Athabasca North	Announced	75,000	TBD	N/A
Nexen Inc.	Long Lake Phase 1	Athabasca South	Operating	58,500	2008	N/A
Nexen Inc.	Long Lake Phase 2	Athabasca South	Approved	58,500		N/A
Nexen Inc.	Long Lake Phase 3	Athabasca South	Application	58,500	TBD	N/A
Nexen Inc.	Long Lake Phase 4	Athabasca South	Announced	58,500	TBD	N/A
Value Creation Inc.	Advanced Tristar ATS-1	Athabasca South	Application	12,750	2016	N/A
Value Creation Inc.	Advanced Tristar ATS-2	Athabasca South	Application	25,500	2018	N/A
Value Creation Inc.	Advanced Tristar ATS-3	Athabasca South	Application	25,500	2020	N/A
Value Creation Inc.	Tristar Pilot	Athabasca South	Application	840	2014	N/A
North West Upgrading Inc.	Redwater Upgrader Phase 1	Industrial Heartland Region	Approved	840	2014	N/A
North West Upgrading Inc.	Redwater Upgrader Phase 2	Industrial Heartland Region	Approved	840	2014	N/A
North West Upgrading Inc.	Redwater Upgrader Phase 3	Industrial Heartland Region	Approved	840	2014	N/A
Shell Albian Sands	Scotford Upgrader 1 Commercial	Industrial Heartland Region	Operating	155,000	2003	N/A
Shell Albian Sands	Scotford Upgrader 1 Expansion	Industrial Heartland Region	Operating	100,000	2003	N/A
Value Creation Inc.	Heartland Phase 1	Industrial Heartland Region	On hold	46,300	TBD	N/A
Value Creation Inc.	Heartland Phase 2	Industrial Heartland Region	Approved	46,300	TBD	N/A
Value Creation Inc.	Heartland Phase 3	Industrial Heartland Region	Approved	46,300	TBD	N/A

ATTACHMENT 6,
WORLD MODEL OVERVIEW AND RESULTS BY ENSYS ENERGY

WORLD Model Overview and Results

This document sets out detailed results from the EnSys WORLD Model cases run by EnSys Energy for the Department of State as a component of its Keystone XL FEIS. To provide readers with a context, the first section below provides an overview of the WORLD Model and its history.

WORLD Model Overview

The world "downstream" petroleum industry, which covers from points of supply for crude oils and non-crude streams through refining and transport to points of demand, has interconnections and market interactions that are global. That what happens in one part of the world impacts other regions is today readily apparent. The industry is also technically complex, has the economic attributes of a co-product industry and contains considerable ability to adjust to changed circumstances. Today, multiple drivers of change exist. Crude oil supplies continue to rise in some parts of the world, including the US (Lower 48) and Canada, while they are in decline in other regions such as the North Sea, Alaska and parts of Asia. Non-crude supplies, encompassing primarily natural gas liquids, biofuels (ethanol, biodiesel) and CTL/GTL streams, are growing at a comparatively fast pace. Consequently, they are taking up a progressively greater proportion of total liquids supply. This is especially the case in the U.S. where large increases in NGL supply are occurring because of the growth in shale gas production. In parallel, product demand is flat to declining in industrialized regions (USA, Canada, Europe, Australasia, Japan), while it is steadily increasing in developing regions, led by Asia. This is creating a long term shift in the location and make-up of product demand.

From a deficit of capacity during its 2004-2008 "golden age," the refining sector is faced today with both surplus - major closures are occurring in Europe and other regions that have declining demand - and with substantial capacity additions, notably in the Middle East and Asia. The result is increased competition for product markets. While processing technology is relatively stable, with generally only gradual evolution, regulatory developments are substantial. Refineries must increasingly produce both land and marine fuels to advanced standards and achieve stricter stationary emissions. Additionally, various regions are implementing climate regulations which place a cost on carbon and/or introduce life-cycle-based low carbon fuel standards. Finally, and generally driven by supply and demand shifts, there are continuing developments in the logistics sector of the industry, as witnessed by the many pipeline and rail initiatives being undertaken in the U.S. and Canada, together with international developments such as the widening of the Panama Canal. All of these affect refining activity and the trading patterns and economics of crude oils and products.

The EnSys Energy WORLD Model was designed to bring all of these key elements of the world petroleum/"liquids" industry together into one simulation tool, in order to realistically address developments that are departures from the status quo and do so across a wide range of time-frames.

First applied 25 years ago in studies of disrupted oil markets for the Department of Energy Office of Strategic Petroleum Reserve, the WORLD Model has since been applied to numerous analyses of essentially every aspect of the “downstream,” including reference outlooks, fuels regulatory studies, e.g. of advanced gasoline and diesel fuels and of international marine fuels, carbon regimes including the Waxman-Markey Bill and studies of planned European Commission regulations, process technology and logistics impacts. Clients include: Department of Energy, Department of State, EPA, EIA, Argonne National Laboratory, major oil companies, technology and catalyst suppliers, the American Petroleum Institute, the OPEC Secretariat, World Bank and International Maritime Organisation.

2013 Keystone XL Study

In 2010, EnSys Energy was asked by the Department of Energy to undertake an assessment of the potential market impacts of the then proposed Keystone XL project. What resulted was an evaluation of a range of potential pipeline scenarios against both a Reference U.S./global demand outlook and a Low U.S. demand / adjusted global demand outlook. The study examined horizons from 2015 to 2030. This 2013 Keystone XL assessment is an update of the prior study that takes into account the major changes that have occurred since 2010, most notably in U.S. crude oil, gas liquids and natural gas supply, in actual logistics facilities installed and operating and in the array of pipeline and now rail projects that exists for transporting crude oil.

The table below sets out the 4 by 4 matrix of supply-demand and pipeline scenarios evaluated in the new analysis. Under each scenario, WORLD Model cases were run for the horizons: 2015, 2017, 2020, 2025, 2030 and 2035. The Model works by “marrying” top down oil supply/demand/world oil price projections, in this study EIA 2013 Annual Energy Outlook cases, with bottom up data within the Model on crude types, refining process capacities and expansion costs, marine, pipeline and rail logistics options, product qualities, and other detail.

Based on the input premises, the Model projects how the downstream industry is likely to adjust and to operate at each study horizon. Longer term horizons implicitly assume that industry has the ability to look ahead and to adapt to the projected scenario. Each set of case results comprises a globally integrated projection for: crude oil, non-crude and product trading patterns/dispositions, refining activities, capacity additions and investments, (closures are implied), refinery secondary operations; also prices/differentials relative to the input market crude price for each crude and each product in each region. These latter are then used to compute total product supply costs for the U.S. and globally and such parameters as net import cost.

Set out in below are full sets of the U.S. oriented results from the cases undertaken in this study[1].

[1] WORLD generates an array of international / global as well as North American case results but the main emphasis here is on projections of impacts across the U.S. and Canada.

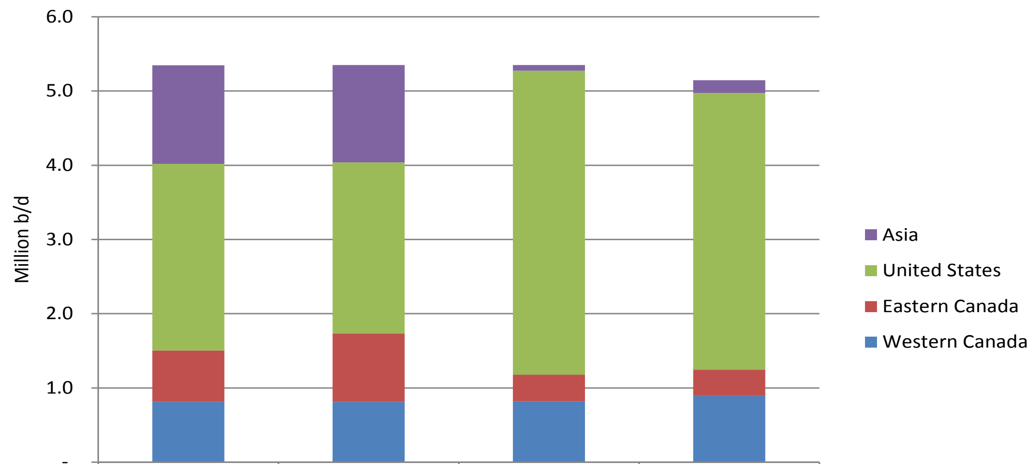
Supply-Demand and Pipeline Cases, and the Resulting Scenarios

	EIA Reference Case	**EIA High Resource Case**	**EIA Low/No Imports Case**	**High Latin American Supply Case**
Unconstrained: Allow all cross border and Canadian east/west pipelines	*Reference Unconstrained Scenario*	*High Resource Unconstrained Scenario*	*Low/No Imports Case Unconstrained Scenario*	*Higher Latin American Unconstrained Scenario*
No East-West Pipelines: Allow cross border pipelines but no new Canadian east/west pipelines or rail to Canadian West Coast	*Reference No East-West Scenario*	*High Resource No East-West Scenario*	*Low/No Imports No East-West Scenario*	*Higher Latin American No East-West Scenario*
No Cross Border Pipelines: No cross border pipelines but allow Canadian east/west pipelines[2]	*Reference No Cross Border Scenario*	*High Resource No Cross Border Scenario*	*Low/No Imports No Cross Border Scenario*	*High Latin American No Cross Border Scenario*
All Constrained: No new cross border, East-West Canadian pipelines, or rail to Canadian West Coast	*Reference Constrained Scenario*	*High Resource Constrained Scenario*	*Low/No Imports Constrained Scenario*	*High Latin American Constrained Scenario*

[2] Where permitted, planned pipelines begin after several years, including the northern leg of TransCanada Keystone XL (2017), TransCanada Energy East (2018), expansion of Kinder Morgan Trans Mountain (2020), and Enbridge Northern Gateway (2025).

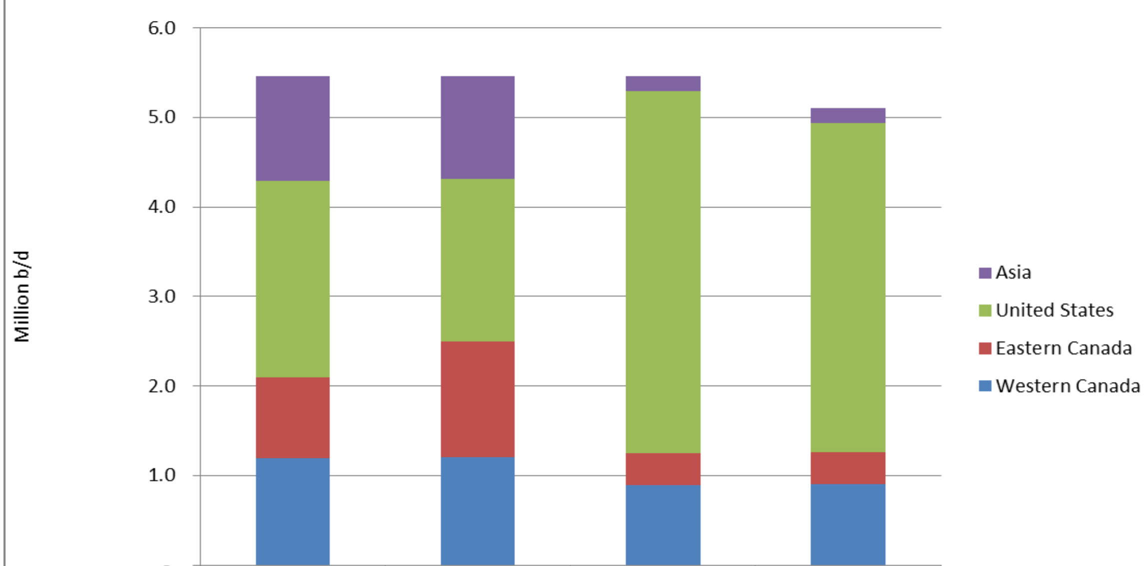
Case Results

Reference Case - WCSB Crude to Markets in 2035



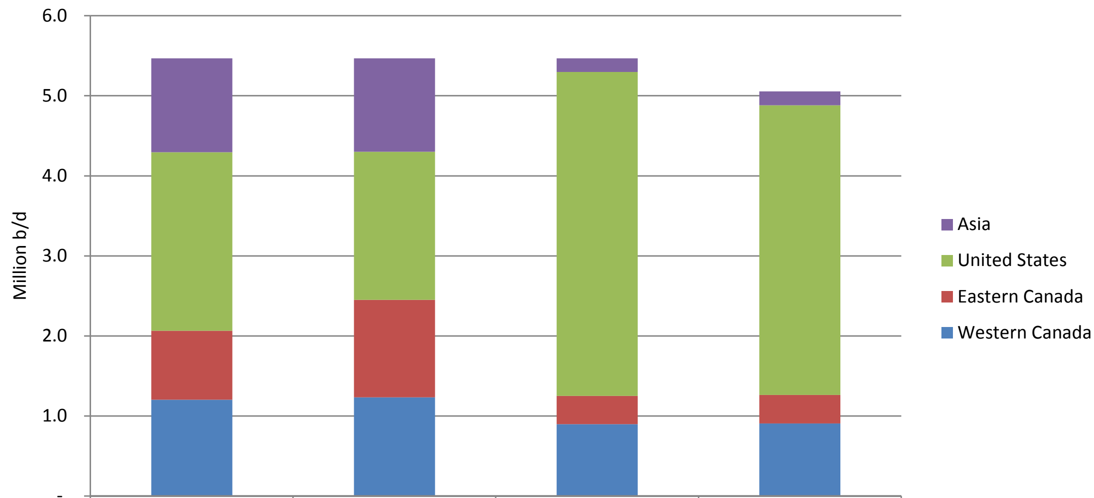
	Unconstrained	No Cross Border	No East-West	All Constrained
Asia	1.33	1.31	0.08	0.17
United States	2.52	2.31	4.09	3.72
Eastern Canada	0.69	0.92	0.36	0.36
Western Canada	0.81	0.81	0.82	0.89

High Resource Case - WCSB Crude to Markets in 2035



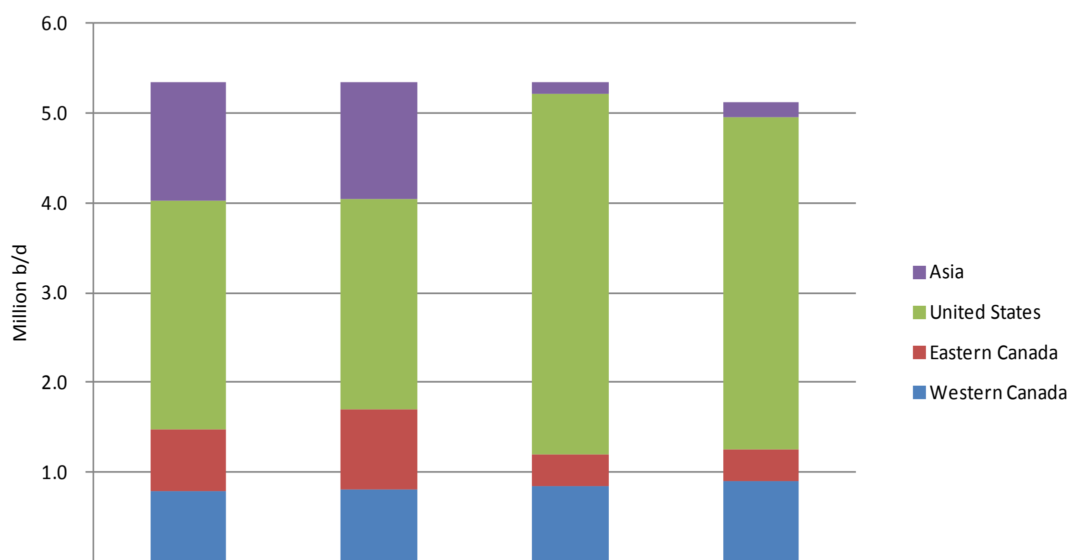
	Unconstrained	No Cross Border	No East-West	All Constrained
Asia	1.17	1.16	0.17	0.17
United States	2.20	1.81	4.04	3.67
Eastern Canada	0.90	1.30	0.36	0.36
Western Canada	1.19	1.20	0.89	0.91

Low and No Net Imports Case - WCSB Crude to Markets in 2035

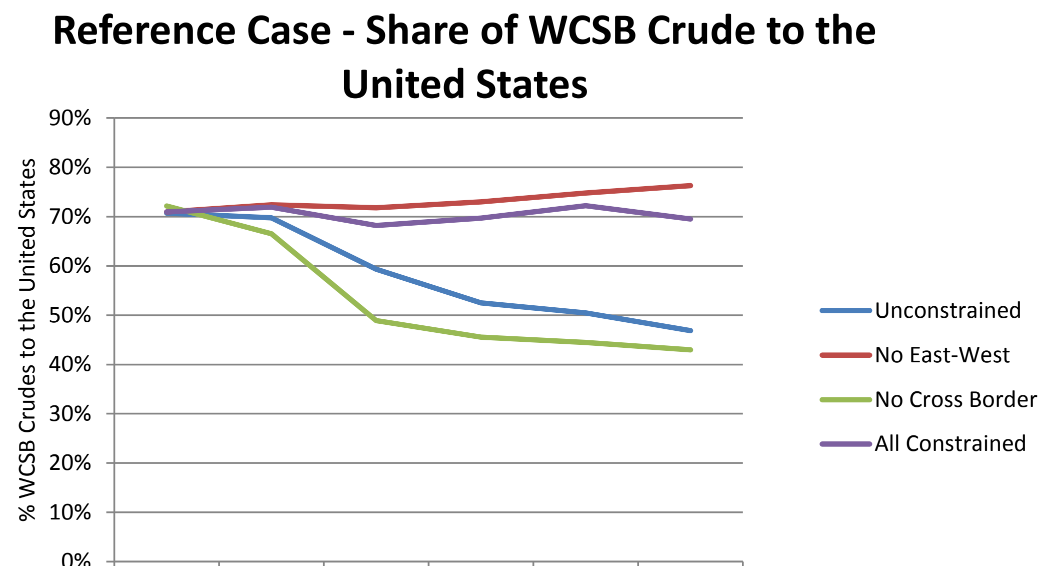


	Unconstrained	No Cross Border	No East-West	All Constrained
Asia	1.17	1.17	0.17	0.17
United States	2.23	1.85	4.04	3.62
Eastern Canada	0.86	1.22	0.36	0.36
Western Canada	1.20	1.23	0.90	0.91

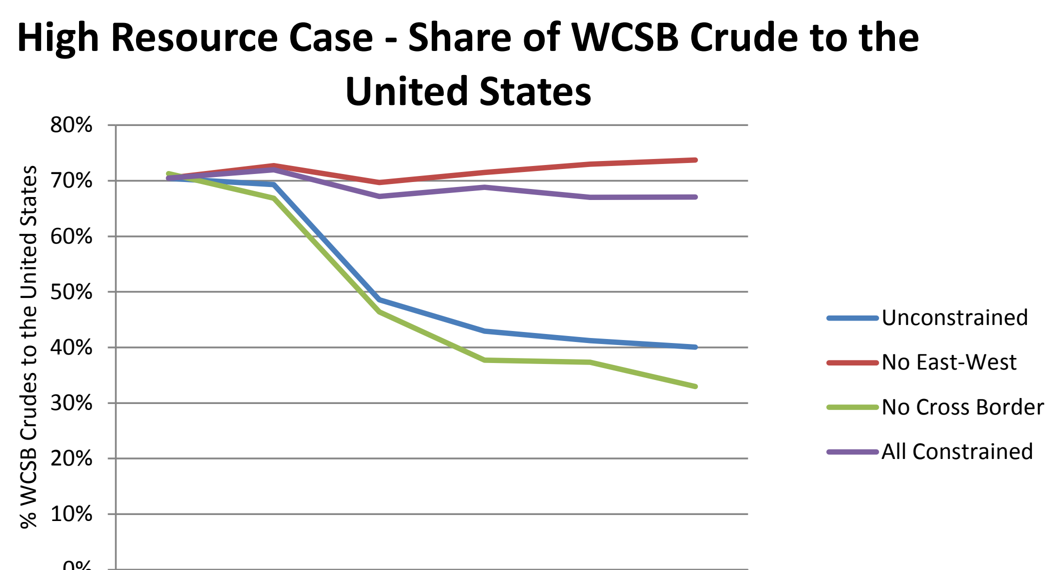
High Latin America Case - WCSB Crude to Markets in 2035



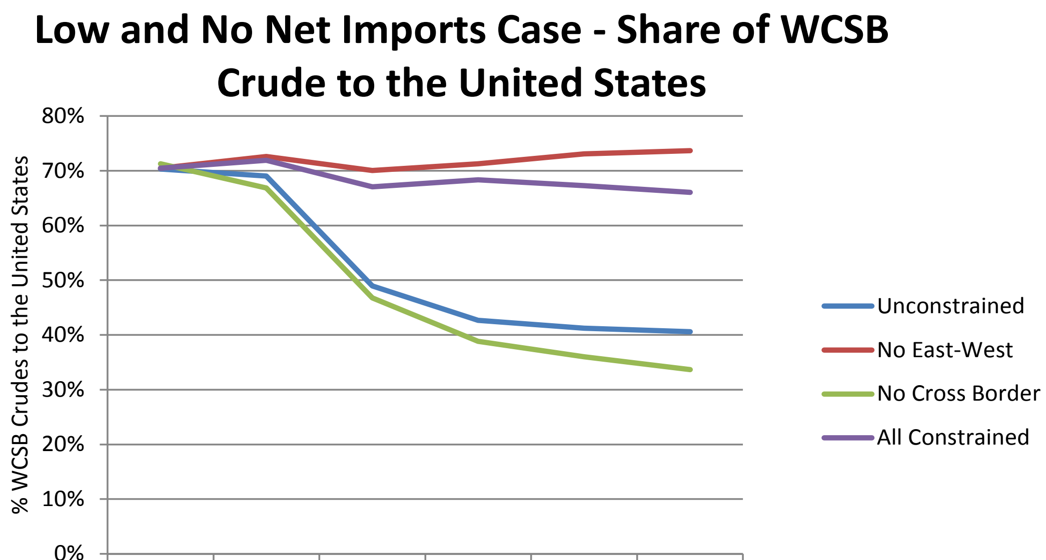
	Unconstrained	No Cross Border	No East-West	All Constrained
Asia	1.33	1.31	0.13	0.17
United States	2.53	2.34	4.02	3.69
Eastern Canada	0.69	0.89	0.36	0.36
Western Canada	0.79	0.80	0.84	0.90



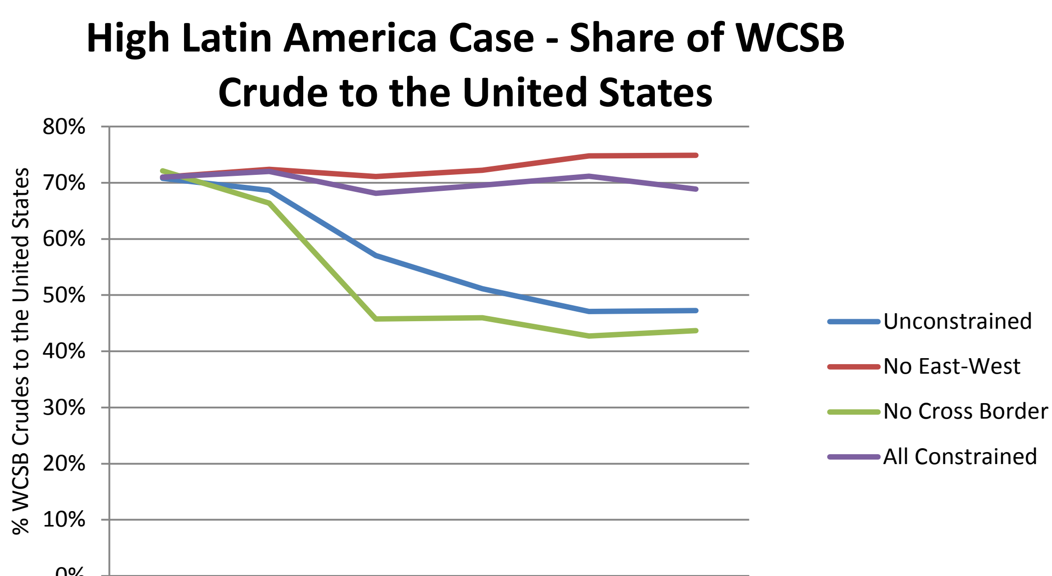
	2015	2017	2020	2025	2030	2035
Unconstrained	71%	70%	59%	53%	50%	47%
No East-West	71%	72%	72%	73%	75%	76%
No Cross Border	72%	66%	49%	46%	44%	43%
All Constrained	71%	72%	68%	70%	72%	69%



	2015	2017	2020	2025	2030	2035
Unconstrained	70%	69%	49%	43%	41%	40%
No East-West	70%	73%	70%	71%	73%	74%
No Cross Border	71%	67%	46%	38%	37%	33%
All Constrained	70%	72%	67%	69%	67%	67%

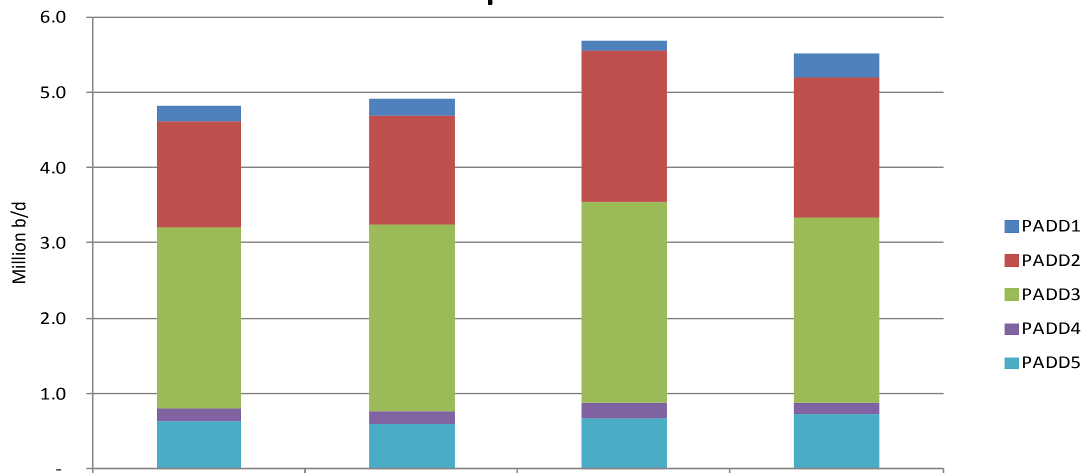


	2015	2017	2020	2025	2030	2035
Unconstrained	70%	69%	49%	43%	41%	41%
No East-West	71%	73%	70%	71%	73%	74%
No Cross Border	71%	67%	47%	39%	36%	34%
All Constrained	71%	72%	67%	68%	67%	66%



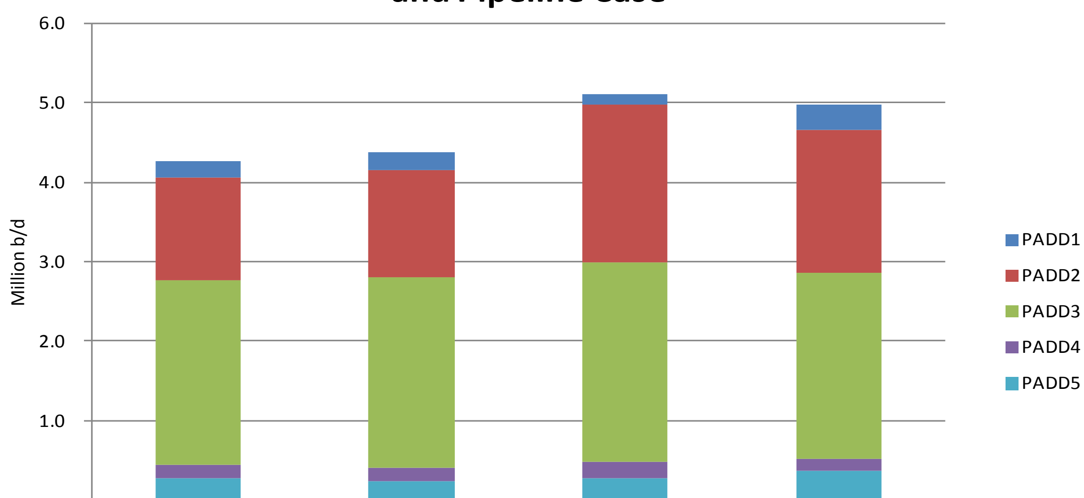
	2015	2017	2020	2025	2030	2035
Unconstrained	71%	69%	57%	51%	47%	47%
No East-West	71%	72%	71%	72%	75%	75%
No Cross Border	72%	66%	46%	46%	43%	44%
All Constrained	71%	72%	68%	70%	71%	69%

Reference Case - Heavy Crude Demand in 2035 by PADD and Pipeline Case



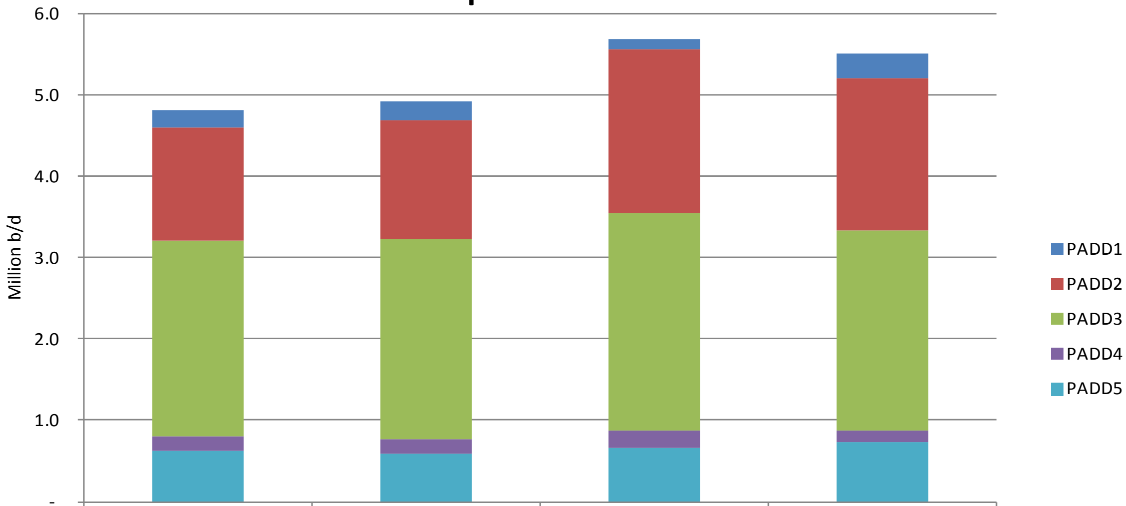
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.40	1.46	2.01	1.86
PADD3	2.39	2.47	2.67	2.46
PADD4	0.18	0.18	0.21	0.15
PADD5	0.63	0.59	0.67	0.73

Reference Case - Heavy Crude Imports in 2035 by PADD and Pipeline Case

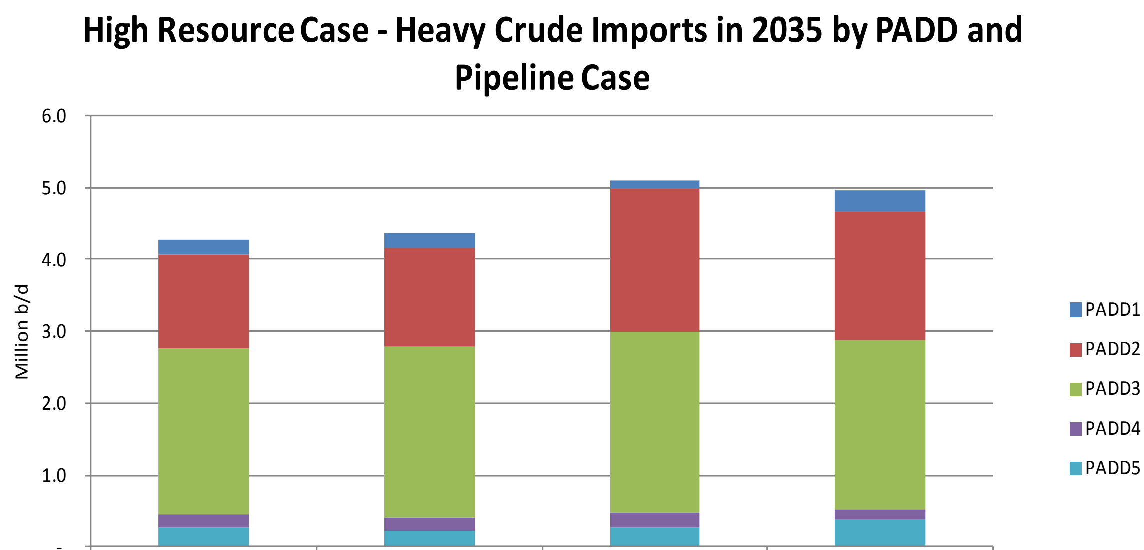


	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.30	1.35	1.98	1.79
PADD3	2.31	2.38	2.51	2.34
PADD4	0.18	0.18	0.21	0.15
PADD5	0.27	0.24	0.27	0.38

High Resource Case - Heavy Crude Demand in 2035 by PADD and Pipeline Case

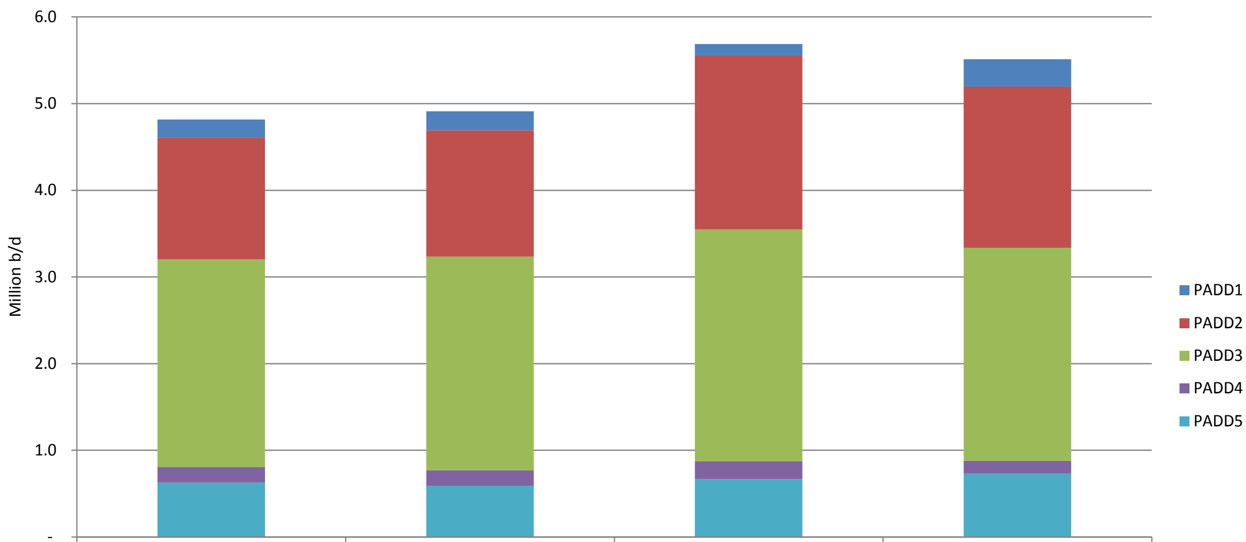


	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.40	1.46	2.01	1.86
PADD3	2.39	2.47	2.67	2.46
PADD4	0.18	0.18	0.21	0.15
PADD5	0.63	0.59	0.67	0.73



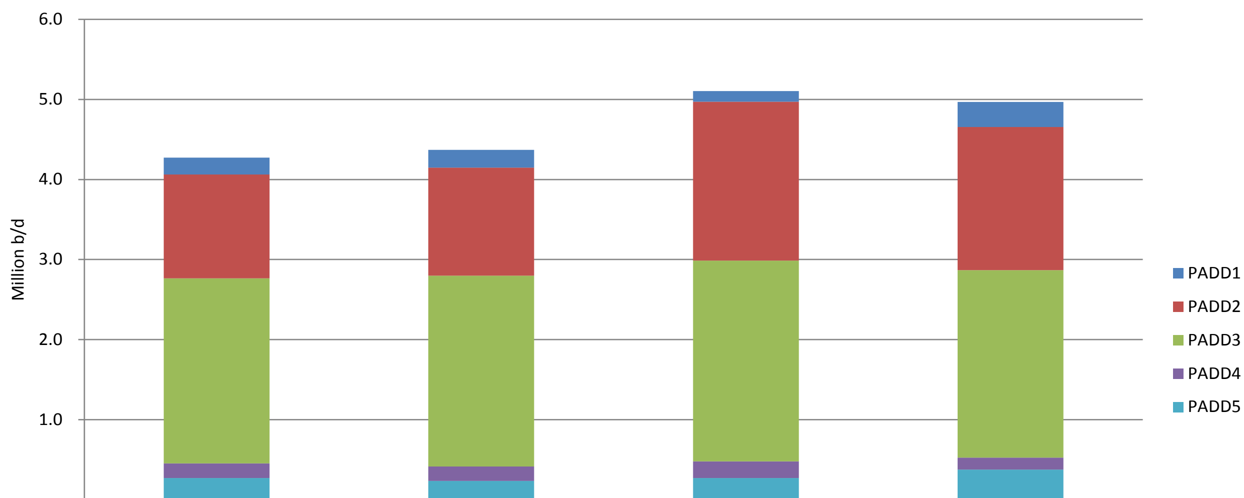
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.30	1.35	1.98	1.79
PADD3	2.31	2.38	2.51	2.34
PADD4	0.18	0.18	0.21	0.15
PADD5	0.27	0.24	0.27	0.38

Low and No Net Imports Case - Heavy Crude Demand in 2035 by PADD and Pipeline Case



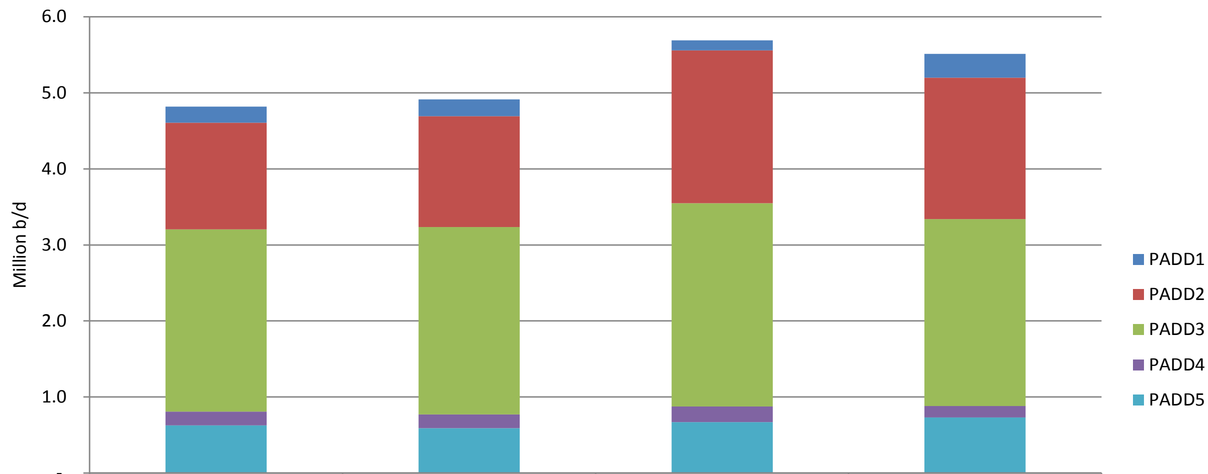
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.40	1.46	2.01	1.86
PADD3	2.39	2.47	2.67	2.46
PADD4	0.18	0.18	0.21	0.15
PADD5	0.63	0.59	0.67	0.73

Low and No Net Imports - Heavy Crude Imports in 2035 by PADD and Pipeline Case



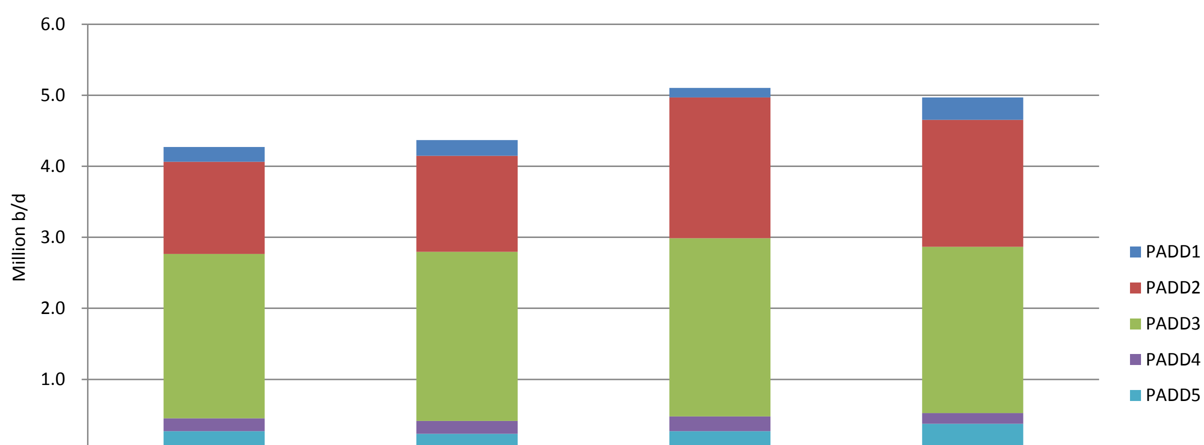
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.30	1.35	1.98	1.79
PADD3	2.31	2.38	2.51	2.34
PADD4	0.18	0.18	0.21	0.15
PADD5	0.27	0.24	0.27	0.38

High Latin America Case - Heavy Crude Demand in 2035 by PADD and Pipeline Case



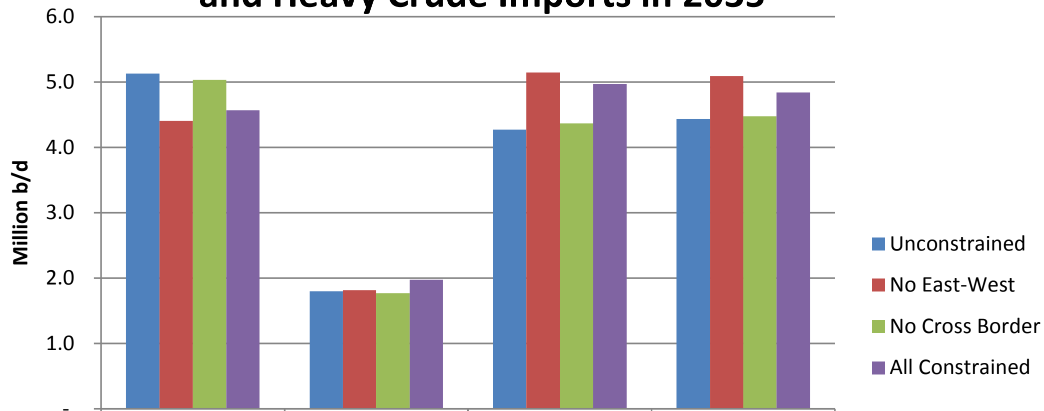
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.40	1.46	2.01	1.86
PADD3	2.39	2.47	2.67	2.46
PADD4	0.18	0.18	0.21	0.15
PADD5	0.63	0.59	0.67	0.73

High Latin America Case - Heavy Crude Imports in 2035 by PADD and Pipeline Case



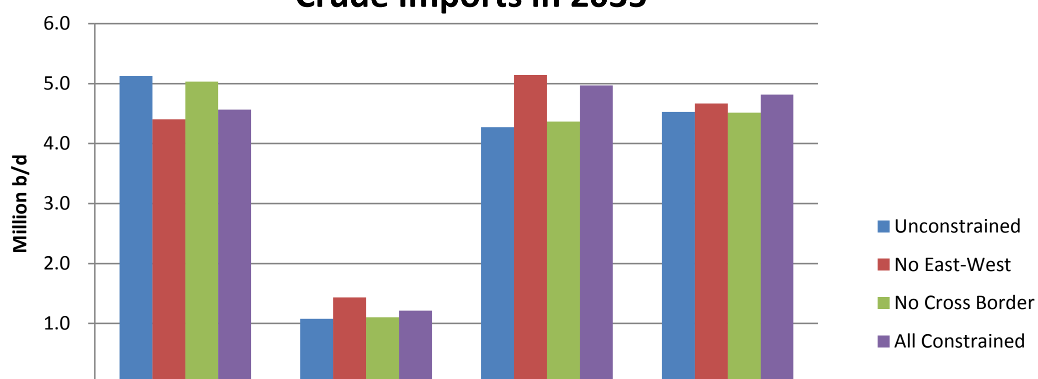
	Unconstrained	No Cross Border	No East-West	All Constrained
PADD1	0.21	0.22	0.13	0.31
PADD2	1.30	1.35	1.98	1.79
PADD3	2.31	2.38	2.51	2.34
PADD4	0.18	0.18	0.21	0.15
PADD5	0.27	0.24	0.27	0.38

Reference and High Resource Case - Light/Medium and Heavy Crude Imports in 2035

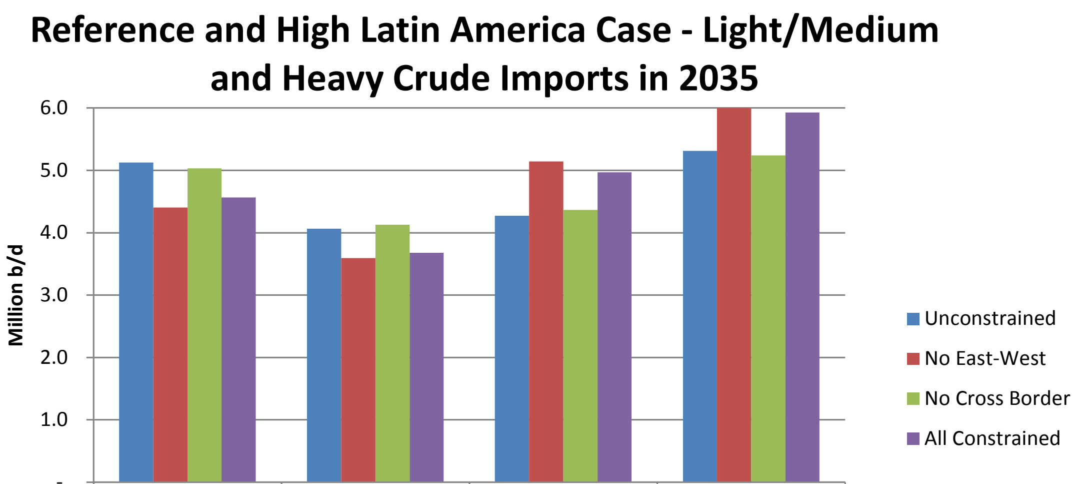


	Reference Case - Light and Medium Crudes	High Resource Case - Light and Medium Crudes	Reference Case - Heavy Crudes	High Resource Case - Heavy Crudes
Unconstrained	5.13	1.80	4.27	4.44
No East-West	4.41	1.82	5.15	5.09
No Cross Border	5.03	1.77	4.37	4.48
All Constrained	4.57	1.98	4.97	4.84

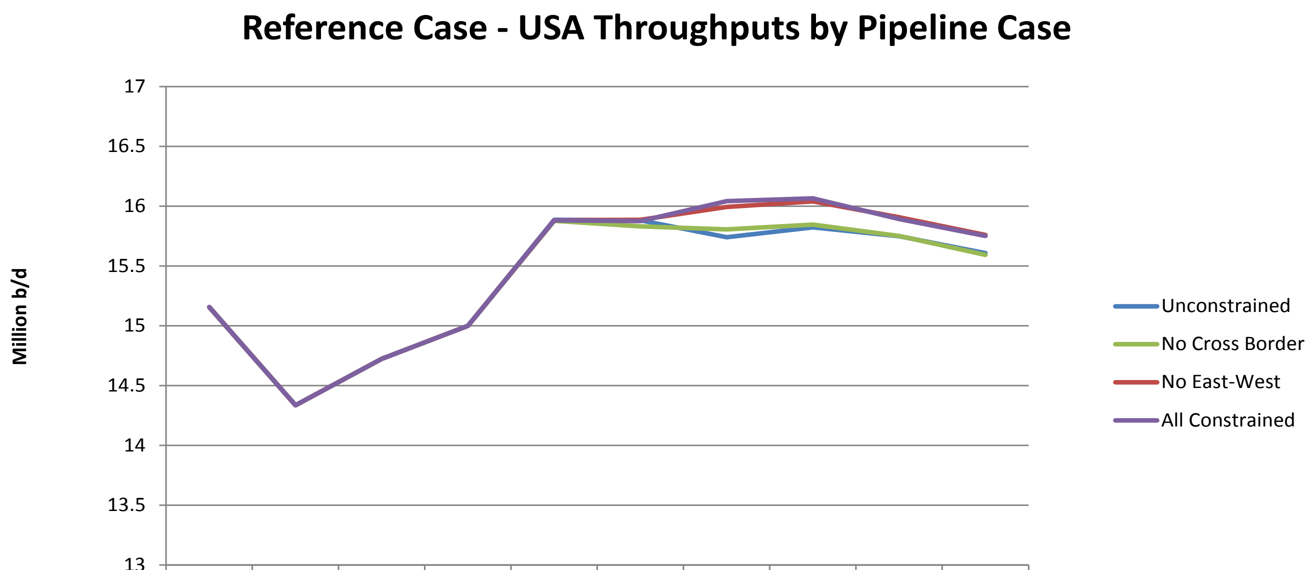
Reference and Low/No Case - Light/Medium and Heavy Crude Imports in 2035



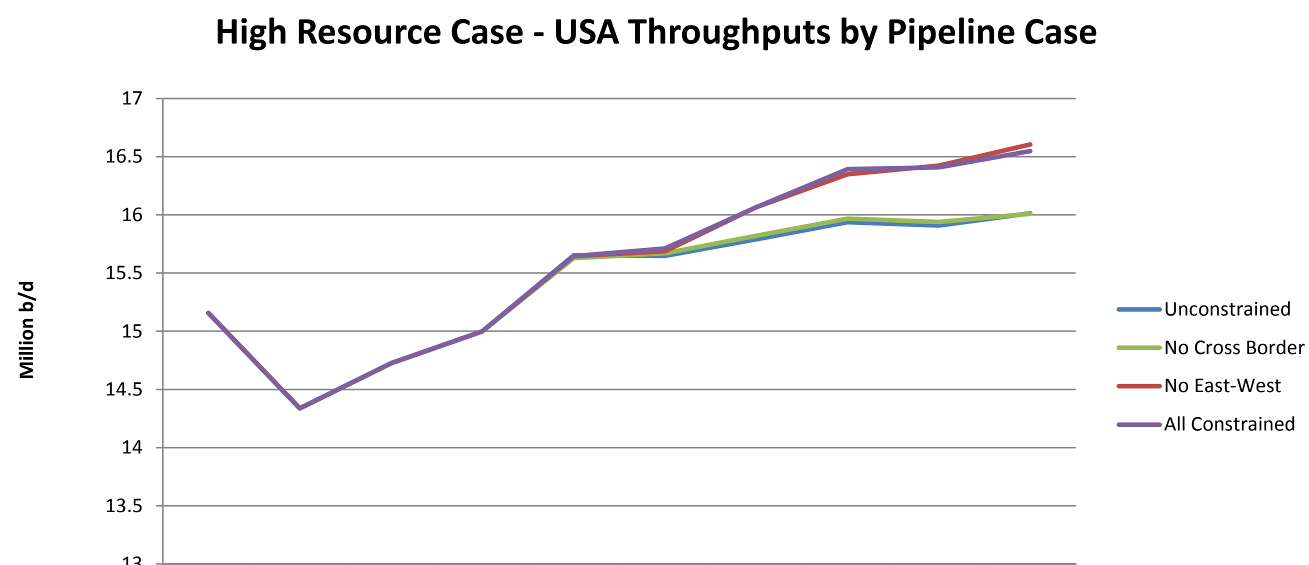
	Reference Case - Light and Medium Crudes	Low/No Imports Case - Light and Medium Crudes	Reference Case - Heavy Crudes	Low/No Imports Case - Heavy Crudes
Unconstrained	5.13	1.08	4.27	4.53
No East-West	4.41	1.43	5.15	4.67
No Cross Border	5.03	1.10	4.37	4.52
All Constrained	4.57	1.21	4.97	4.82



	Reference Case - Light and Medium Crudes	High Latin America Case - Light and Medium Crudes	Reference Case - Heavy Crudes	High Latin America Case - Heavy Crudes
Unconstrained	5.13	4.07	4.27	5.31
No East-West	4.41	3.60	5.15	6.14
No Cross Border	5.03	4.13	4.37	5.24
All Constrained	4.57	3.68	4.97	5.93

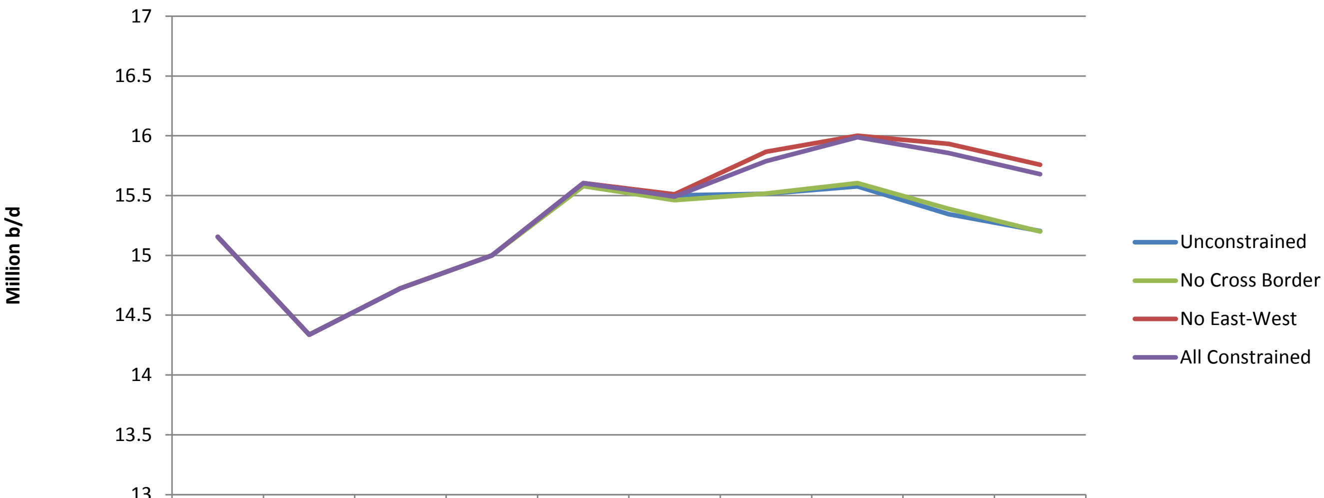


	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	15.156	14.336	14.72	15.00	15.89	15.88	15.74	15.82	15.75	15.61
No Cross Border	15.156	14.336	14.72	15.00	15.88	15.83	15.81	15.85	15.75	15.59
No East-West	15.156	14.336	14.72	15.00	15.88	15.89	15.99	16.04	15.91	15.76
All Constrained	15.156	14.336	14.72	15.00	15.88	15.87	16.04	16.06	15.89	15.75



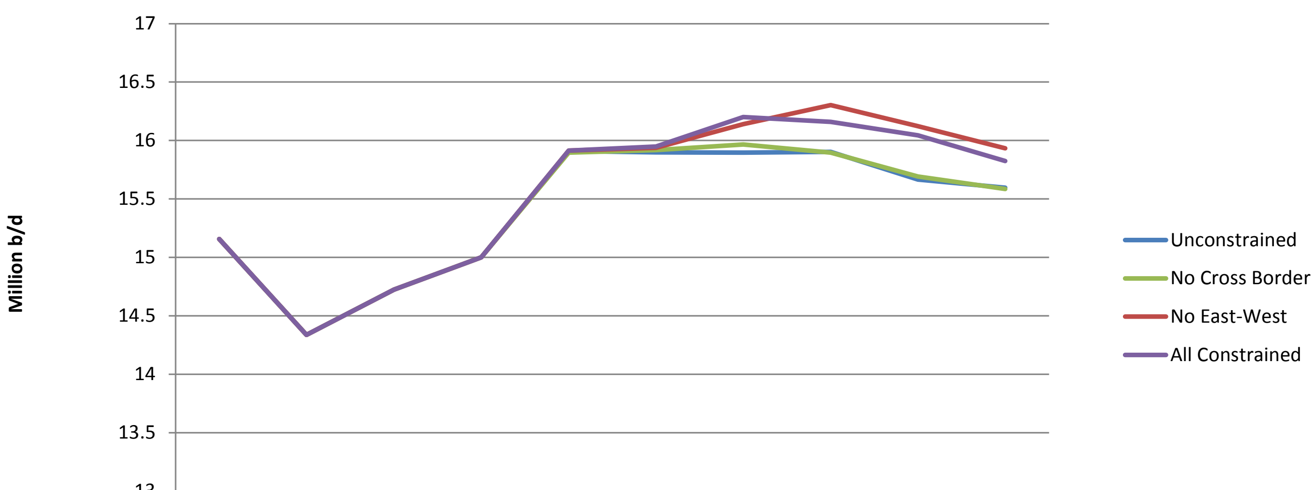
	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	15.156	14.336	14.72	15.00	15.65	15.65	15.79	15.94	15.91	16.01
No Cross Border	15.156	14.336	14.72	15.00	15.63	15.67	15.82	15.97	15.94	16.01
No East-West	15.156	14.336	14.72	15.00	15.64	15.69	16.07	16.35	16.42	16.61
All Constrained	15.156	14.336	14.72	15.00	15.64	15.71	16.07	16.39	16.41	16.55

Low and No Net Imports Case - USA Throughputs by Pipeline Case

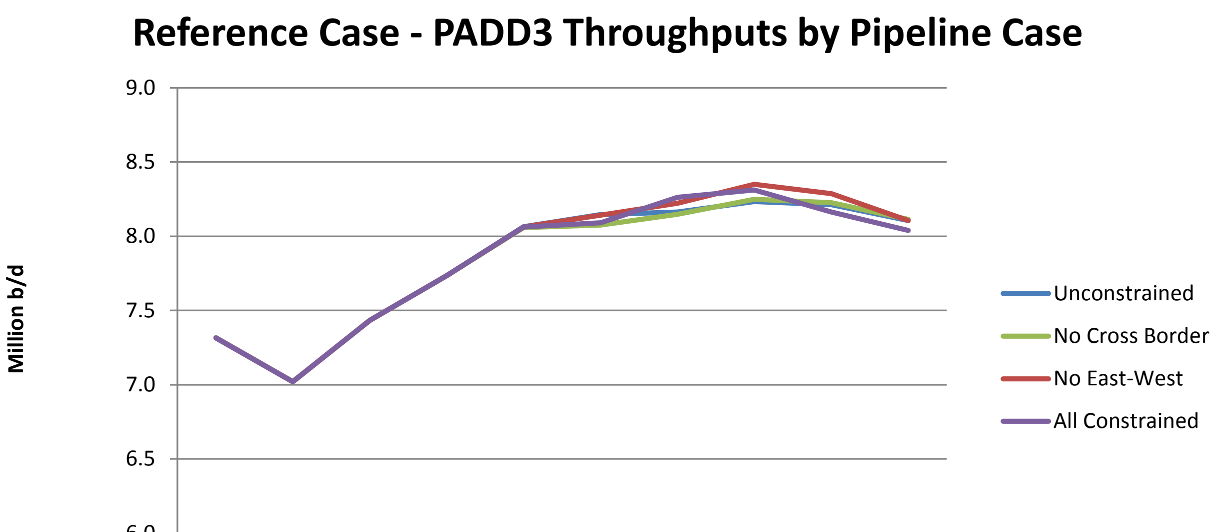


	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	15.156	14.336	14.72	15.00	15.60	15.50	15.52	15.58	15.35	15.20
No Cross Border	15.156	14.336	14.72	15.00	15.58	15.46	15.52	15.61	15.39	15.20
No East-West	15.156	14.336	14.72	15.00	15.60	15.51	15.87	16.00	15.93	15.76
All Constrained	15.156	14.336	14.72	15.00	15.60	15.49	15.79	15.99	15.86	15.68

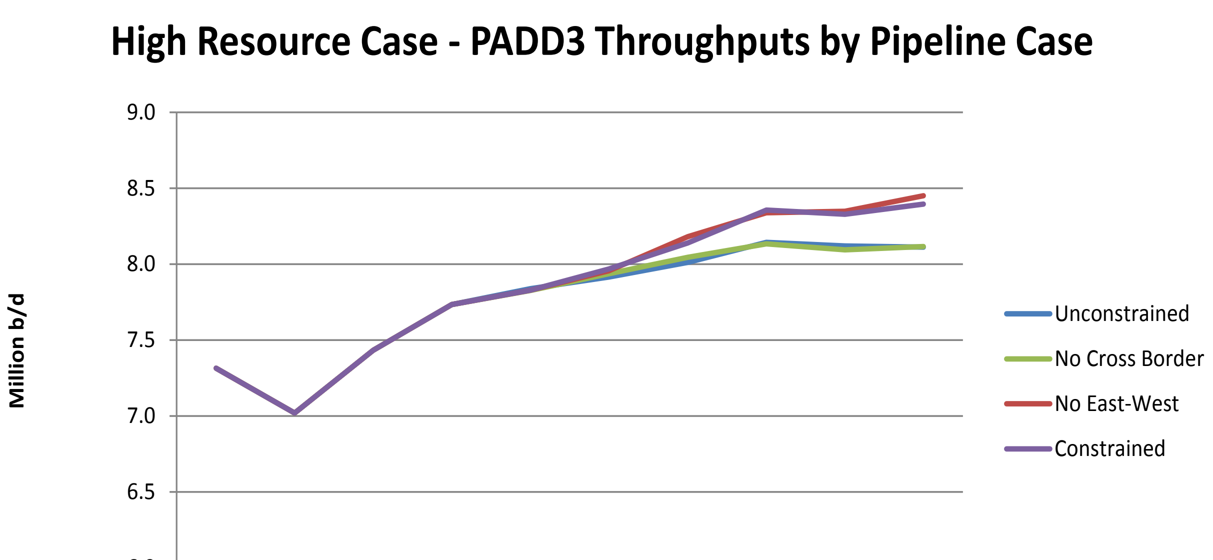
High Latin America Case - USA Throughputs by Pipeline Case



	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	15.156	14.336	14.72	15.00	15.91	15.90	15.90	15.90	15.67	15.60
No Cross Border	15.156	14.336	14.72	15.00	15.90	15.92	15.97	15.90	15.69	15.58
No East-West	15.156	14.336	14.72	15.00	15.91	15.94	16.14	16.30	16.12	15.93
All Constrained	15.156	14.336	14.72	15.00	15.91	15.95	16.20	16.16	16.04	15.82

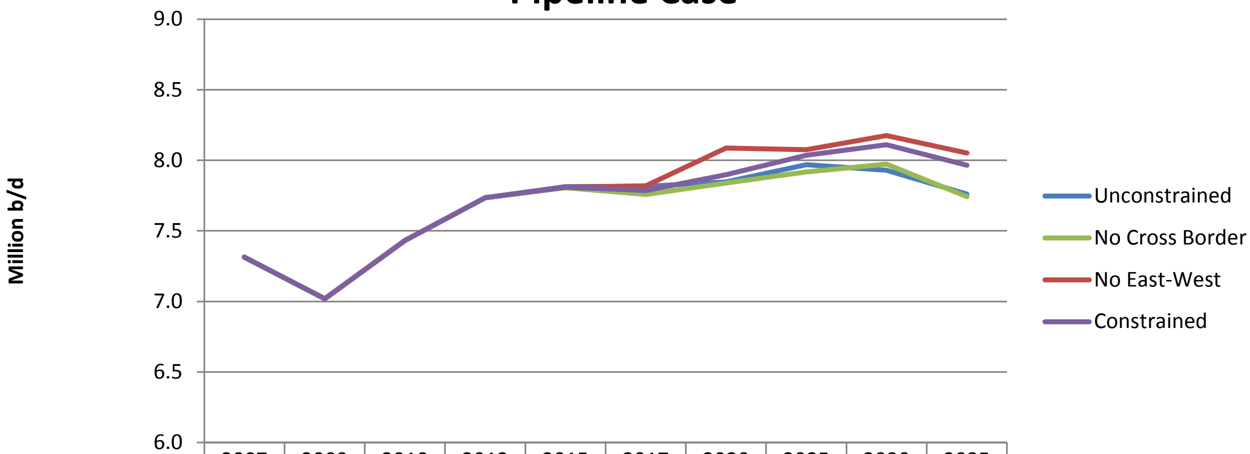


	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	7.315	7.02	7.43	7.73	8.06	8.15	8.16	8.23	8.21	8.11
No Cross Border	7.315	7.02	7.43	7.73	8.06	8.08	8.15	8.25	8.23	8.11
No East-West	7.315	7.02	7.43	7.73	8.06	8.14	8.22	8.35	8.29	8.11
All Constrained	7.315	7.02	7.43	7.73	8.06	8.09	8.26	8.31	8.16	8.04



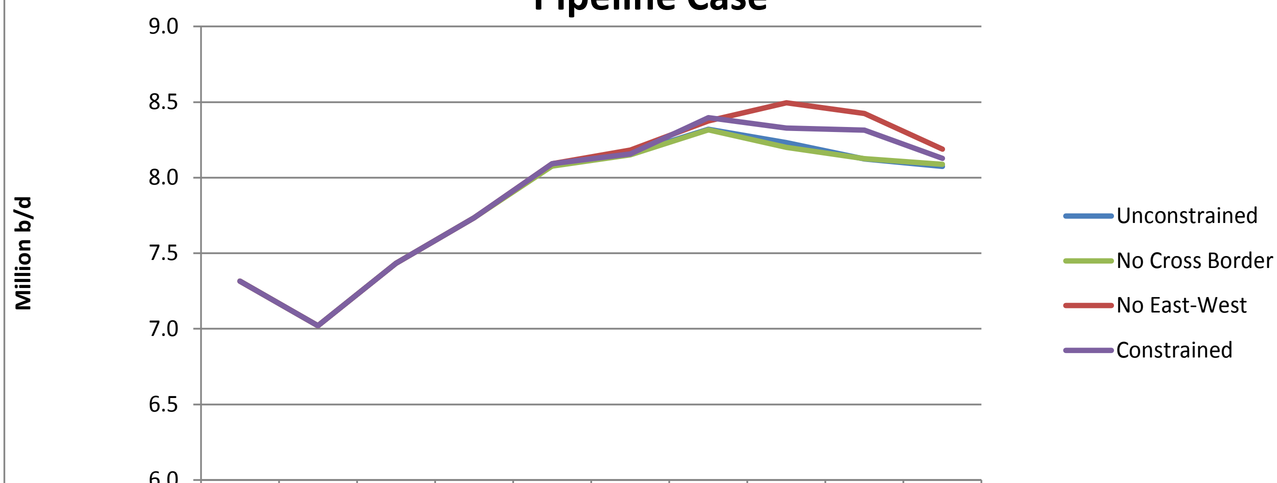
	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	7.315	7.02	7.43	7.73	7.84	7.92	8.01	8.14	8.12	8.11
No Cross Border	7.315	7.02	7.43	7.73	7.83	7.94	8.04	8.13	8.09	8.11
No East-West	7.315	7.02	7.43	7.73	7.83	7.96	8.18	8.34	8.35	8.45
Constrained	7.315	7.02	7.43	7.73	7.83	7.97	8.14	8.36	8.33	8.40

Low and No Net Imports Case - PADD3 Throughputs by Pipeline Case

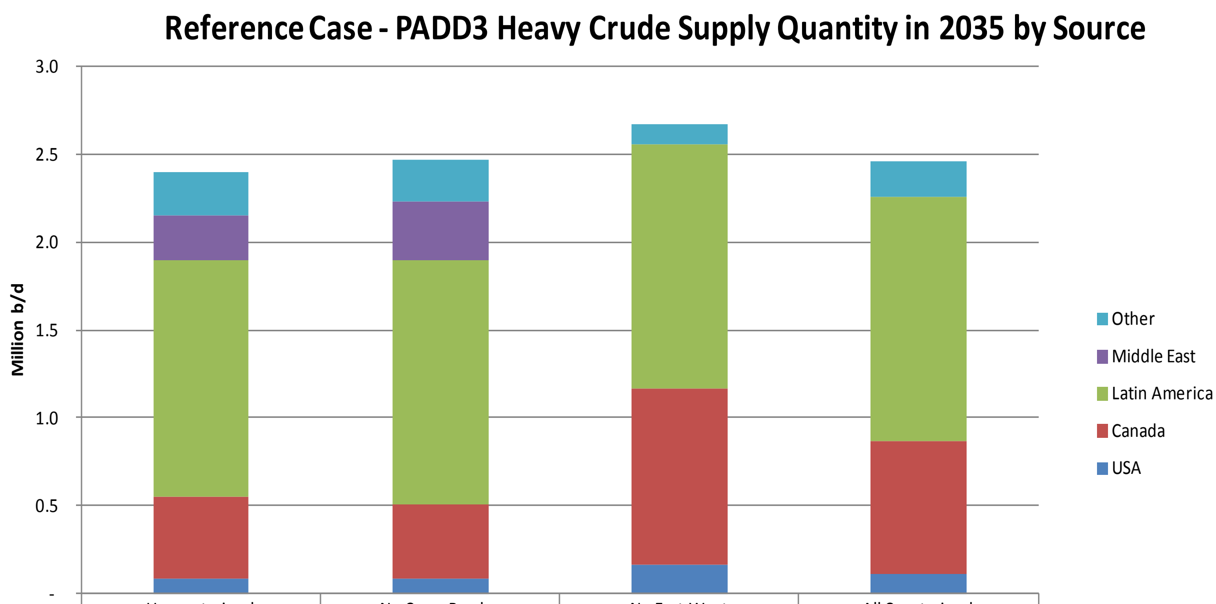


	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	7.315	7.02	7.43	7.73	7.81	7.82	7.85	7.97	7.93	7.76
No Cross Border	7.315	7.02	7.43	7.73	7.81	7.76	7.84	7.92	7.97	7.74
No East-West	7.315	7.02	7.43	7.73	7.81	7.82	8.09	8.08	8.18	8.05
Constrained	7.315	7.02	7.43	7.73	7.81	7.79	7.90	8.04	8.11	7.96

High Latin America Case - PADD3 Throughputs by Pipeline Case

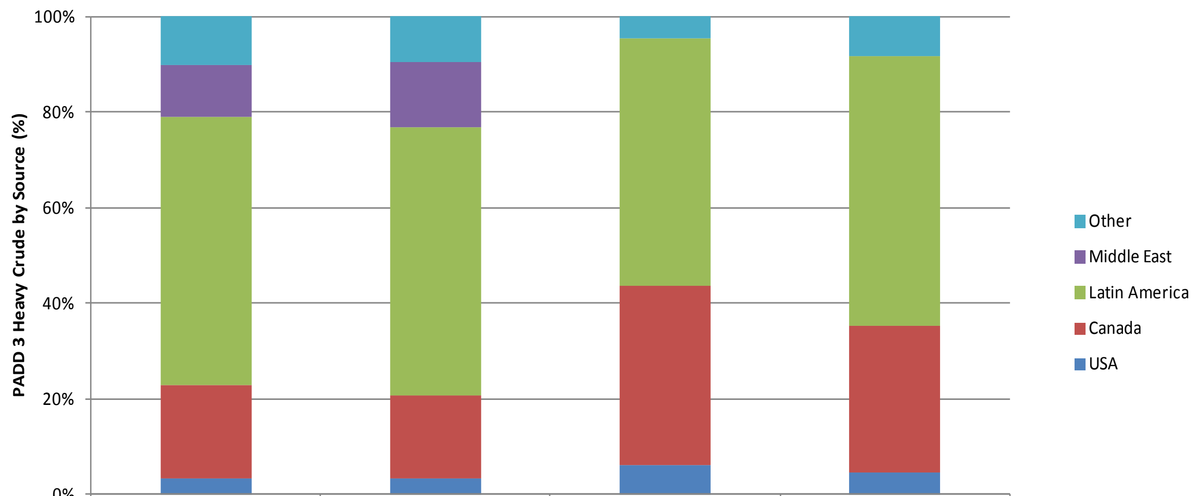


	2007	2009	2010	2012	2015	2017	2020	2025	2030	2035
Unconstrained	7.315	7.02	7.43	7.73	8.09	8.16	8.32	8.23	8.12	8.07
No Cross Border	7.315	7.02	7.43	7.73	8.08	8.15	8.32	8.20	8.13	8.09
No East-West	7.315	7.02	7.43	7.73	8.09	8.18	8.37	8.50	8.43	8.19
Constrained	7.315	7.02	7.43	7.73	8.09	8.16	8.40	8.33	8.32	8.13



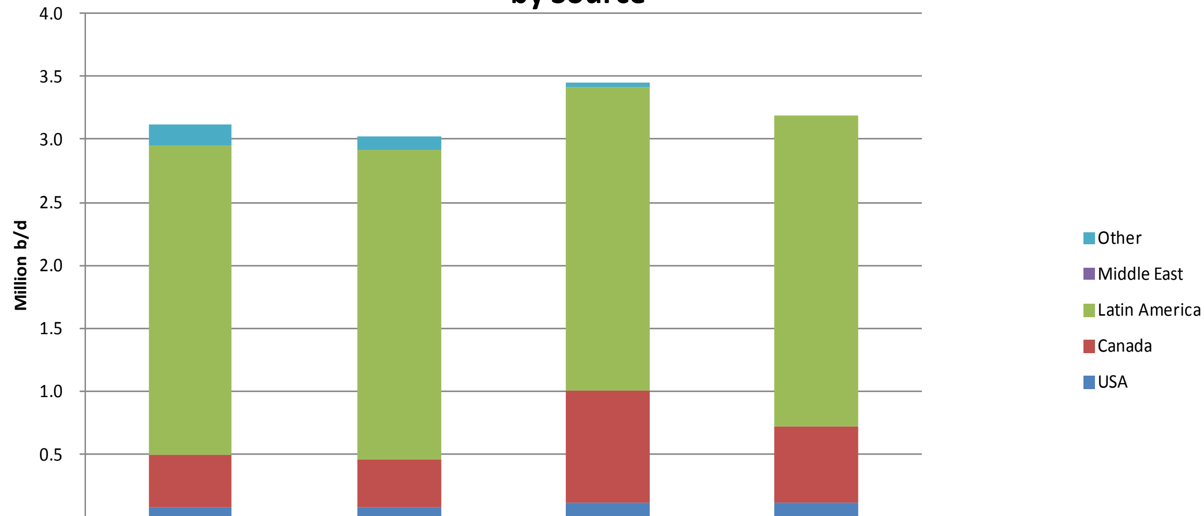
	Unconstrained	No Cross Border	No East-West	All Constrained
Other	0.25	0.23	0.12	0.20
Middle East	0.25	0.34	-	-
Latin America	1.35	1.38	1.39	1.39
Canada	0.47	0.43	1.00	0.76
USA	0.08	0.08	0.16	0.11

Reference Case - PADD3 Heavy Crude Supply Percentage in 2035 by Source



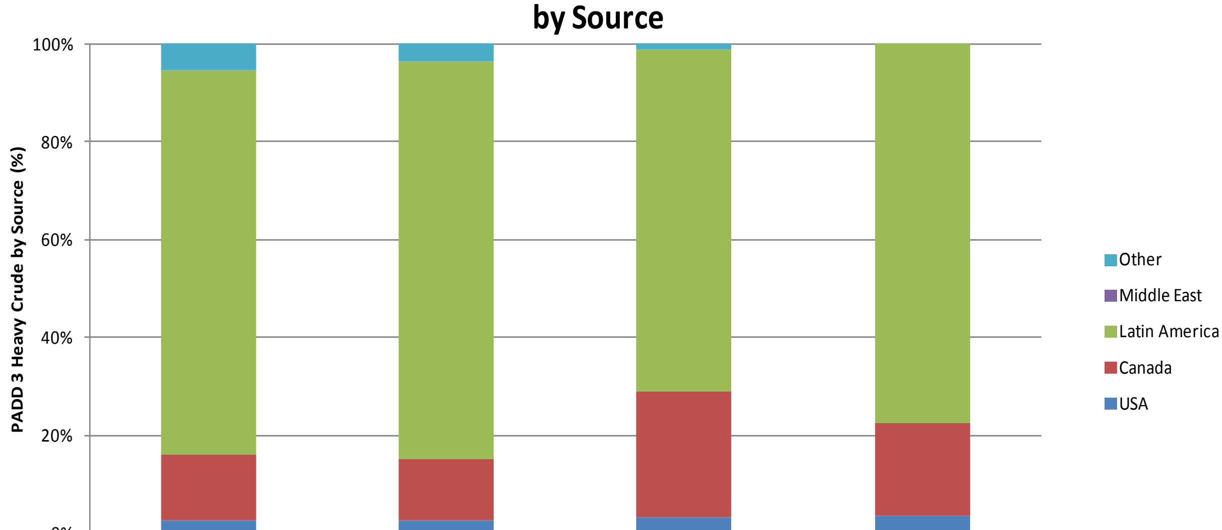
	Unconstrained	No Cross Border	No East-West	All Constrained
Other	10%	10%	4%	8%
Middle East	11%	14%	0%	0%
Latin America	56%	56%	52%	56%
Canada	19%	17%	38%	31%
USA	3%	3%	6%	5%

High Latin America Case - PADD3 Heavy Crude Supply Quantity in 2035 by Source



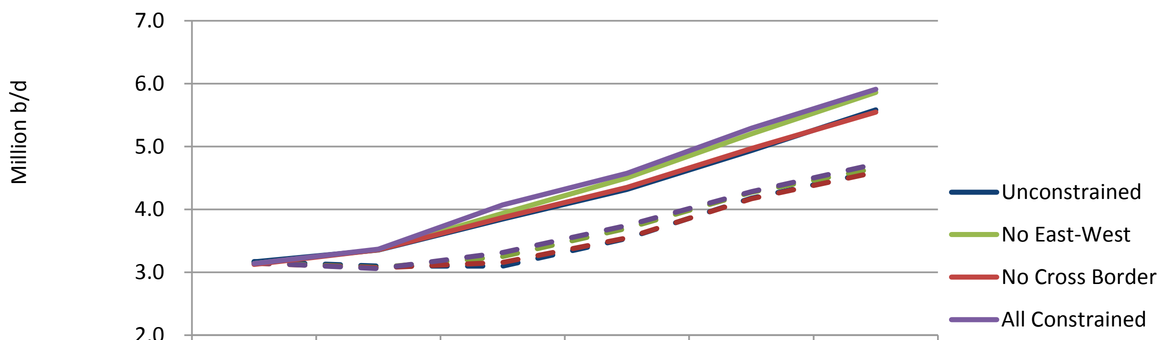
	Unconstrained	No Cross Border	No East-West	All Constrained
Other	0.16	0.11	0.04	-
Middle East	-	-	-	-
Latin America	2.45	2.46	2.41	2.47
Canada	0.42	0.38	0.89	0.61
USA	0.08	0.08	0.11	0.11

High Latin America Case - PADD3 Heavy Crude Supply Percentage in 2035 by Source



	Unconstrained	No Cross Border	No East-West	All Constrained
Other	5%	4%	1%	0%
Middle East	0%	0%	0%	0%
Latin America	79%	81%	70%	77%
Canada	13%	12%	26%	19%
USA	3%	3%	3%	4%

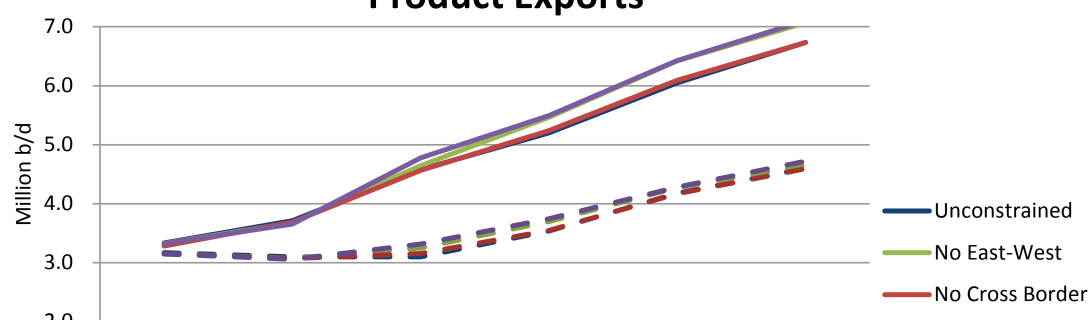
Reference and High Resource Case - Net Petroleum Product Exports



	2015	2017	2020	2025	2030	2035
Unconstrained	3.17	3.10	3.10	3.54	4.18	4.60
No East-West	3.15	3.08	3.25	3.70	4.27	4.65
No Cross Border	3.14	3.07	3.16	3.55	4.17	4.59
All Constrained	3.15	3.06	3.31	3.75	4.28	4.72
Unconstrained	3.17	3.35	3.85	4.32	4.94	5.58
No East-West	3.14	3.36	3.93	4.50	5.20	5.86
No Cross Border	3.13	3.36	3.87	4.35	4.97	5.55
All Constrained	3.14	3.37	4.07	4.57	5.29	5.91

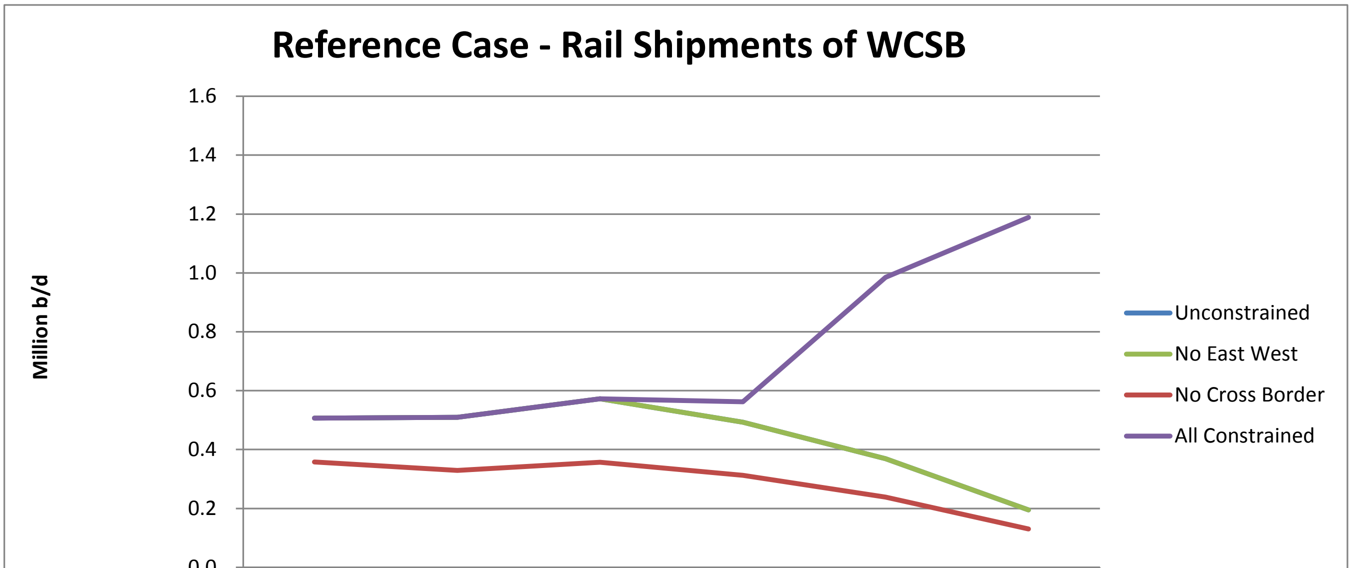
Dashed lines are corresponding Reference case pipeline scenarios

Reference and Low/No Case - Net Petroleum Product Exports

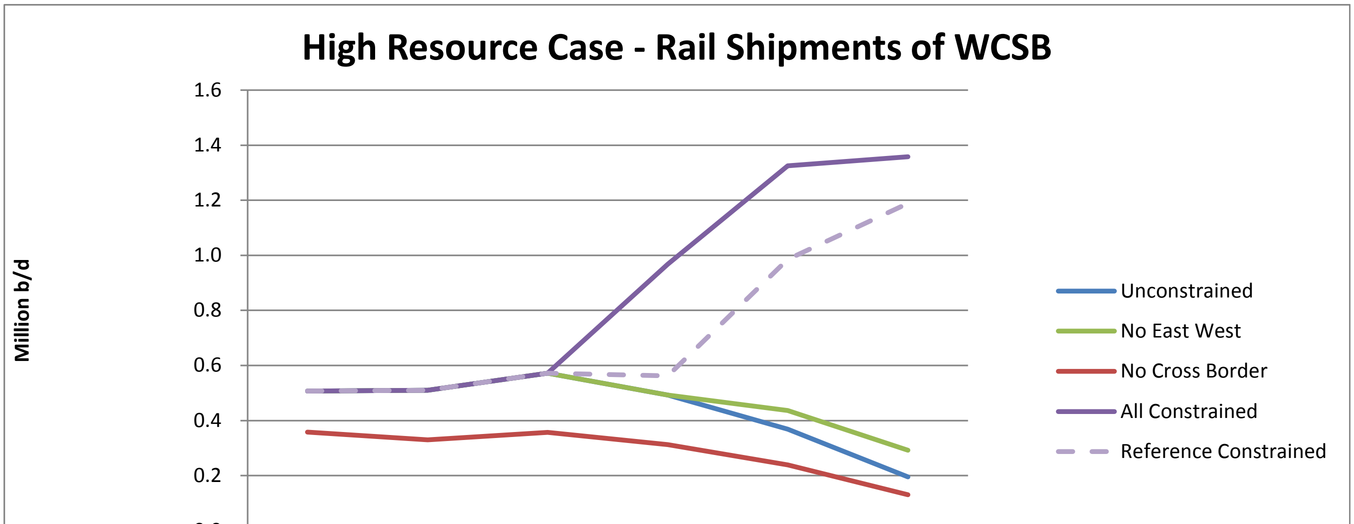


	2015	2017	2020	2025	2030	2035
Unconstrained	3.17	3.10	3.10	3.54	4.18	4.60
No East-West	3.15	3.08	3.25	3.70	4.27	4.65
No Cross Border	3.14	3.07	3.16	3.55	4.17	4.59
All Constrained	3.15	3.06	3.31	3.75	4.28	4.72
Unconstrained	3.33	3.71	4.58	5.20	6.05	6.74
No East-West	3.33	3.68	4.65	5.46	6.42	7.07
No Cross Border	3.28	3.69	4.57	5.24	6.09	6.73
All Constrained	3.33	3.65	4.78	5.49	6.43	7.11

Dashed lines are corresponding Reference case pipeline scenarios

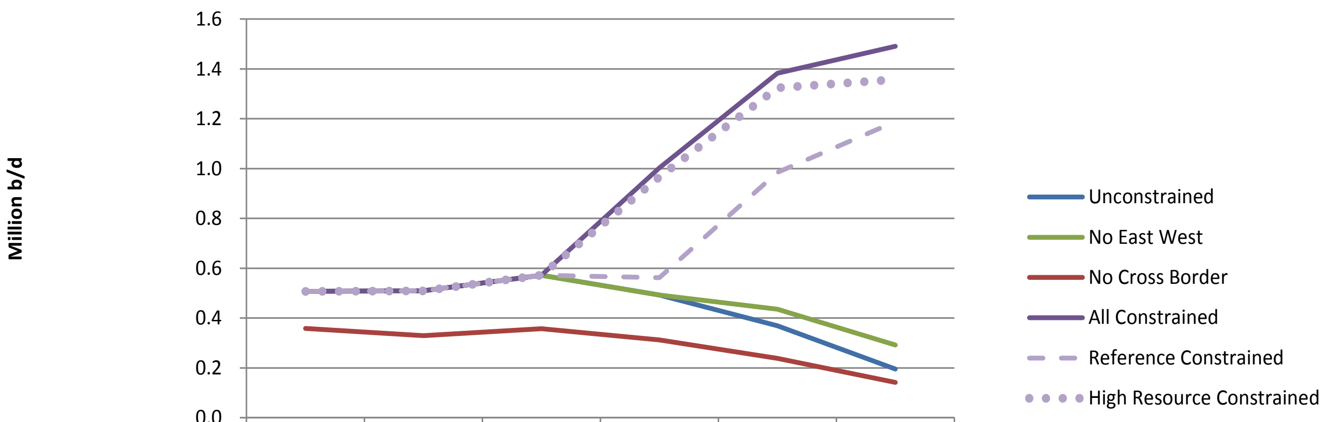


	2015	2017	2020	2025	2030	2035
Unconstrained	0.507	0.510	0.572	0.493	0.369	0.195
No East West	0.507	0.510	0.572	0.493	0.369	0.195
No Cross Border	0.358	0.330	0.357	0.313	0.239	0.130
All Constrained	0.507	0.510	0.572	0.562	0.985	1.188



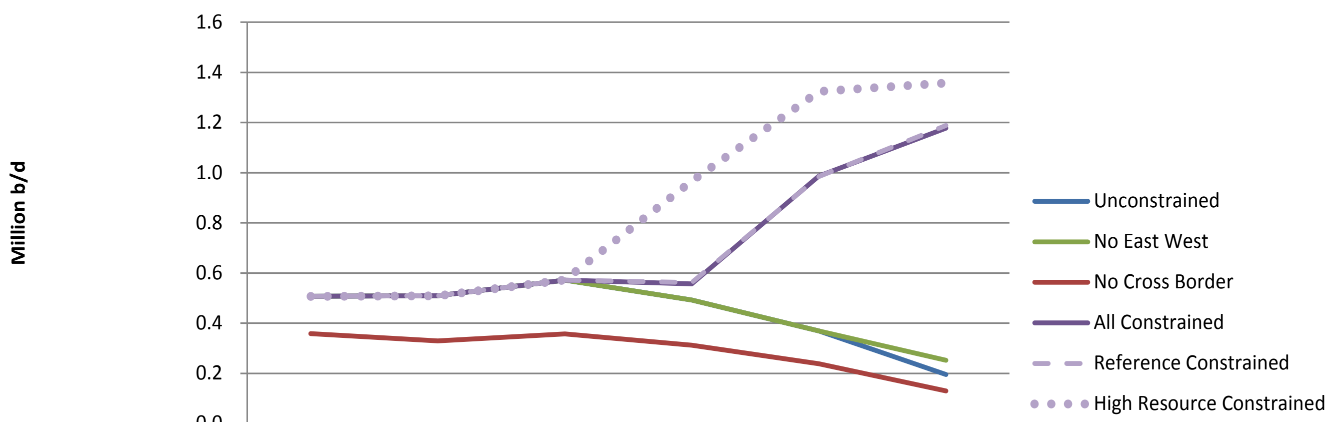
	2015	2017	2020	2025	2030	2035
Unconstrained	0.507	0.510	0.572	0.493	0.369	0.195
No East West	0.507	0.510	0.572	0.493	0.436	0.292
No Cross Border	0.358	0.330	0.357	0.313	0.239	0.130
All Constrained	0.507	0.510	0.572	0.968	1.325	1.358
Reference Constrained	0.507	0.510	0.572	0.562	0.985	1.188

Low and No Net Imports Case - Rail Shipments of WCSB

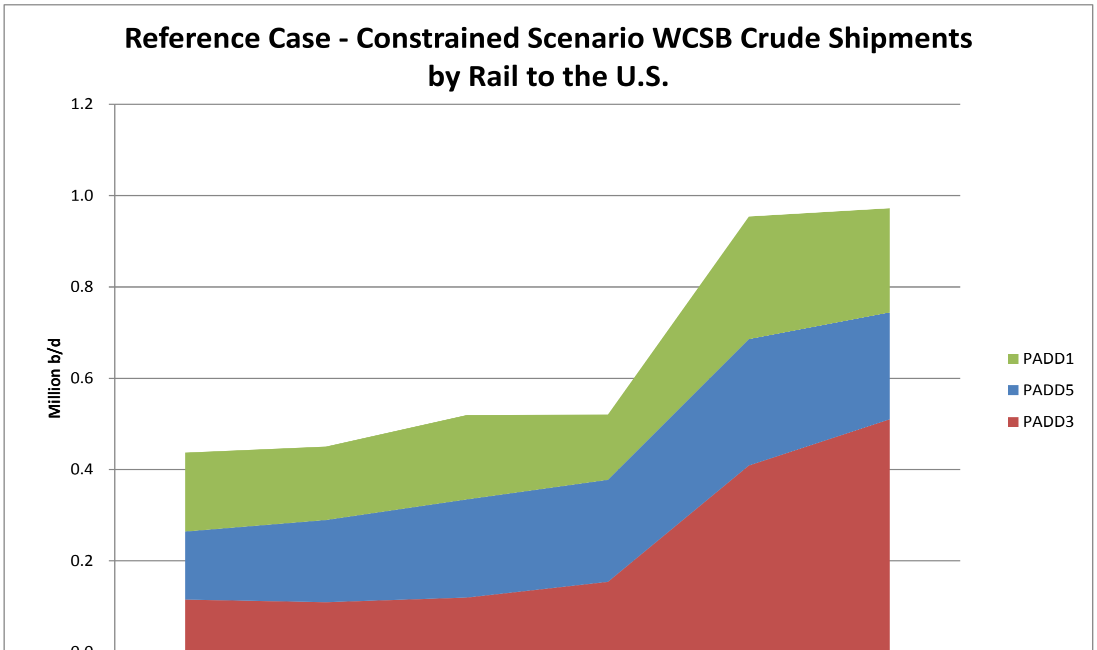


	2015	2017	2020	2025	2030	2035
Unconstrained	0.507	0.510	0.572	0.493	0.369	0.195
No East West	0.507	0.510	0.572	0.493	0.436	0.292
No Cross Border	0.358	0.330	0.357	0.313	0.239	0.142
All Constrained	0.507	0.510	0.572	1.003	1.382	1.491
Reference Constrained	0.507	0.510	0.572	0.562	0.985	1.188
High Resource Constrained	0.507	0.510	0.572	0.968	1.325	1.358

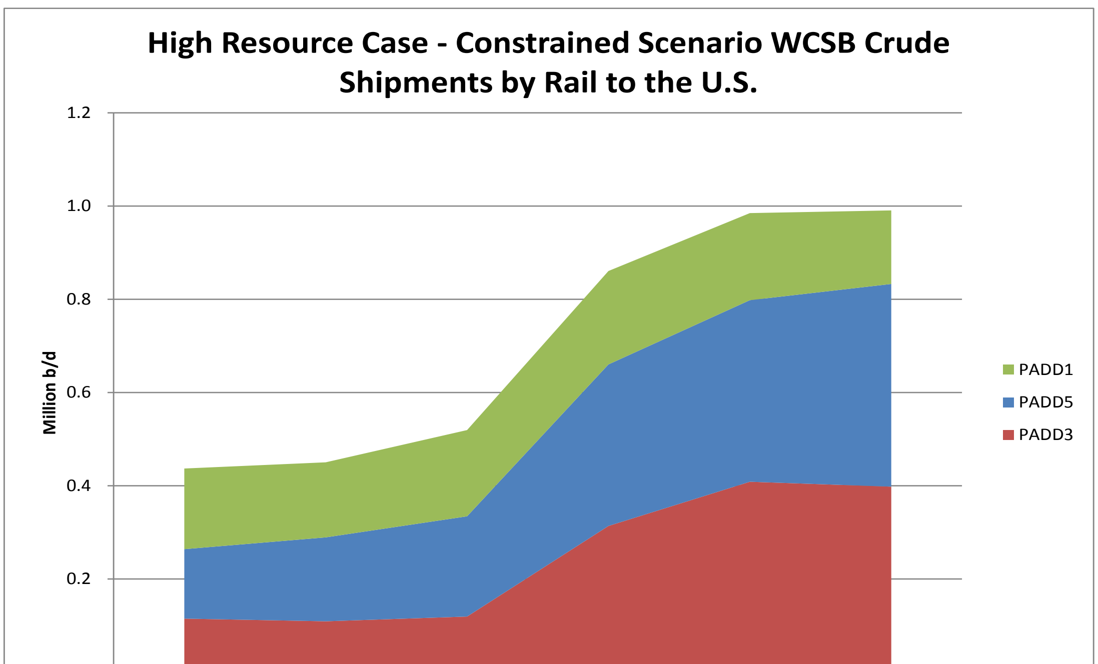
High Latin America Imports Case - Rail Shipments of WCSB



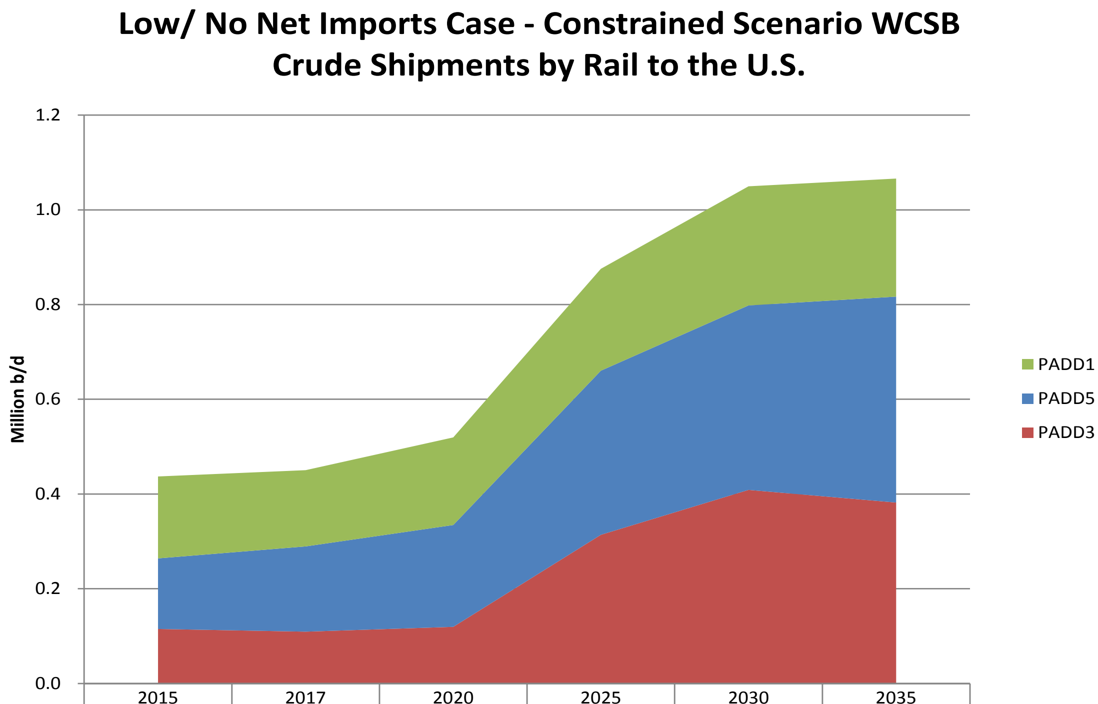
	2015	2017	2020	2025	2030	2035
Unconstrained	0.507	0.510	0.572	0.493	0.369	0.195
No East West	0.507	0.510	0.572	0.493	0.369	0.253
No Cross Border	0.358	0.330	0.357	0.313	0.239	0.130
All Constrained	0.507	0.510	0.572	0.557	0.987	1.178
Reference Constrained	0.507	0.510	0.572	0.562	0.985	1.188
High Resource Constrained	0.507	0.510	0.572	0.968	1.325	1.358



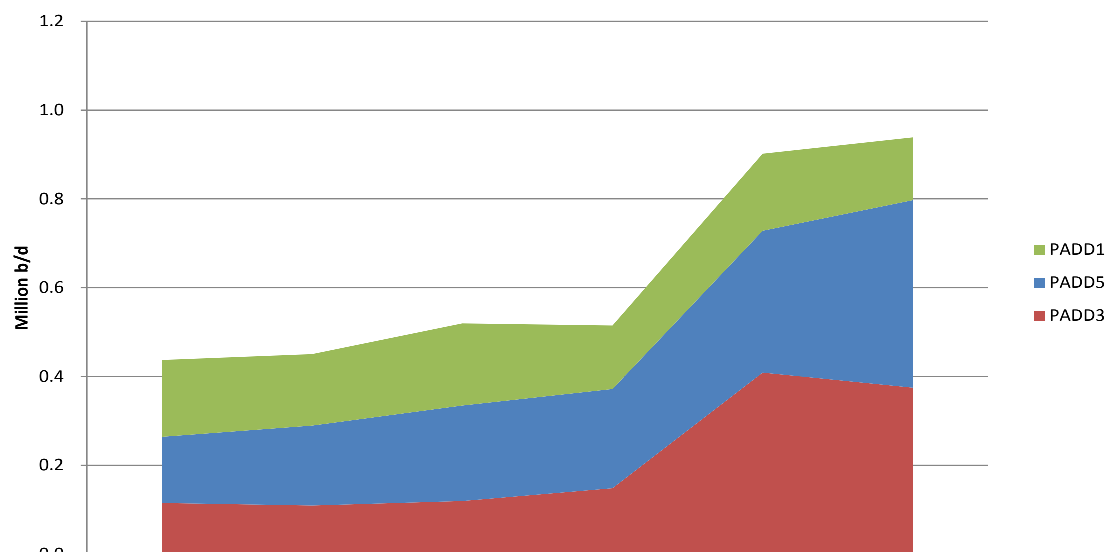
	2015	2017	2020	2025	2030	2035
PADD1	0.173	0.161	0.185	0.143	0.269	0.228
PADD5	0.149	0.180	0.215	0.223	0.277	0.234
PADD3	0.115	0.109	0.120	0.154	0.409	0.510



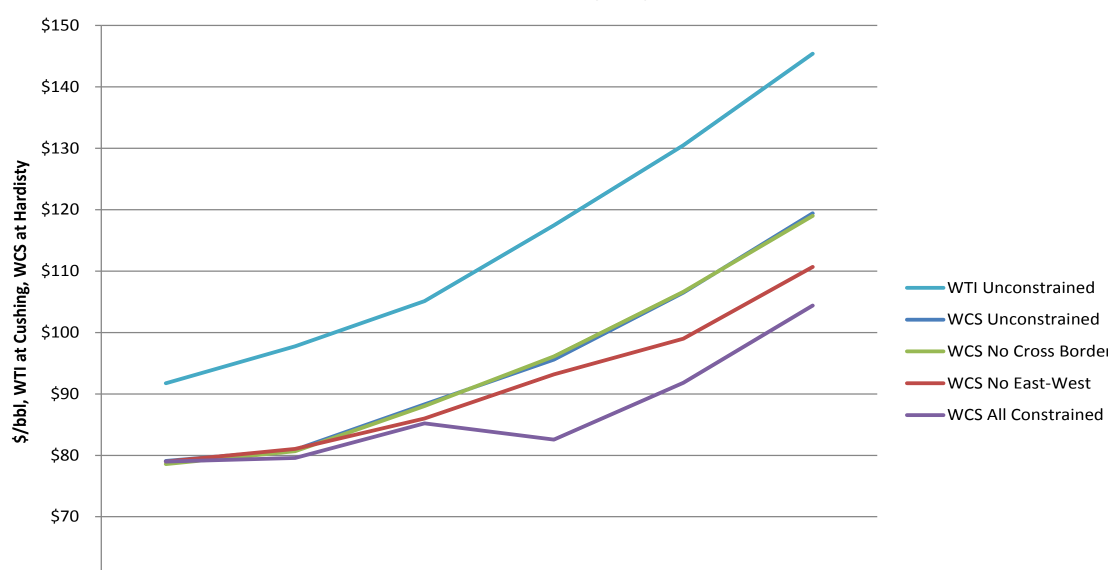
	2015	2017	2020	2025	2030	2035
PADD1	0.173	0.161	0.185	0.200	0.187	0.158
PADD5	0.149	0.180	0.215	0.346	0.389	0.435
PADD3	0.115	0.109	0.120	0.314	0.409	0.398



	2015	2017	2020	2025	2030	2035
PADD1	0.173	0.161	0.185	0.215	0.252	0.249
PADD5	0.149	0.180	0.215	0.346	0.389	0.435
PADD3	0.115	0.109	0.120	0.314	0.409	0.382

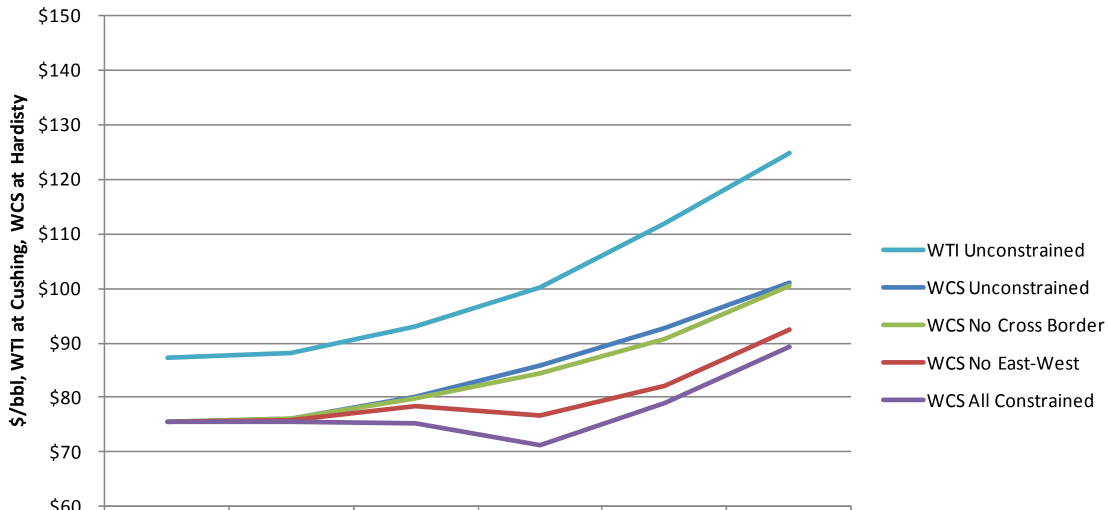


	2015	2017	2020	2025	2030	2035
PADD1	0.173	0.161	0.185	0.143	0.174	0.141
PADD5	0.149	0.180	0.215	0.223	0.319	0.422
PADD3	0.115	0.109	0.120	0.148	0.409	0.375



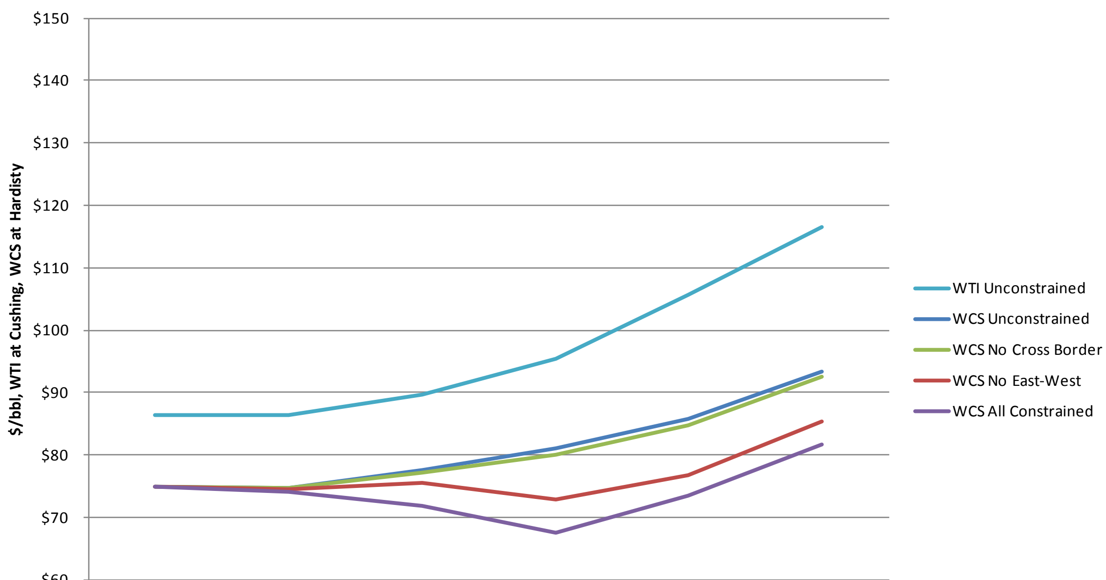
	2015	2017	2020	2025	2030	2035
WTI Unconstrained	$91.74	$97.75	$105.12	$117.47	$130.50	$145.39
WCS Unconstrained	$79.09	$80.93	$88.32	$95.60	$106.48	$119.40
WCS No Cross Border	$78.58	$80.68	$88.02	$96.10	$106.62	$119.00
WCS No East-West	$79.00	$81.06	$86.01	$93.19	$98.98	$110.67
WCS All Constrained	$79.00	$79.56	$85.20	$82.56	$91.80	$104.38

High Resource Case - WCS Prices by Pipeline Scenario



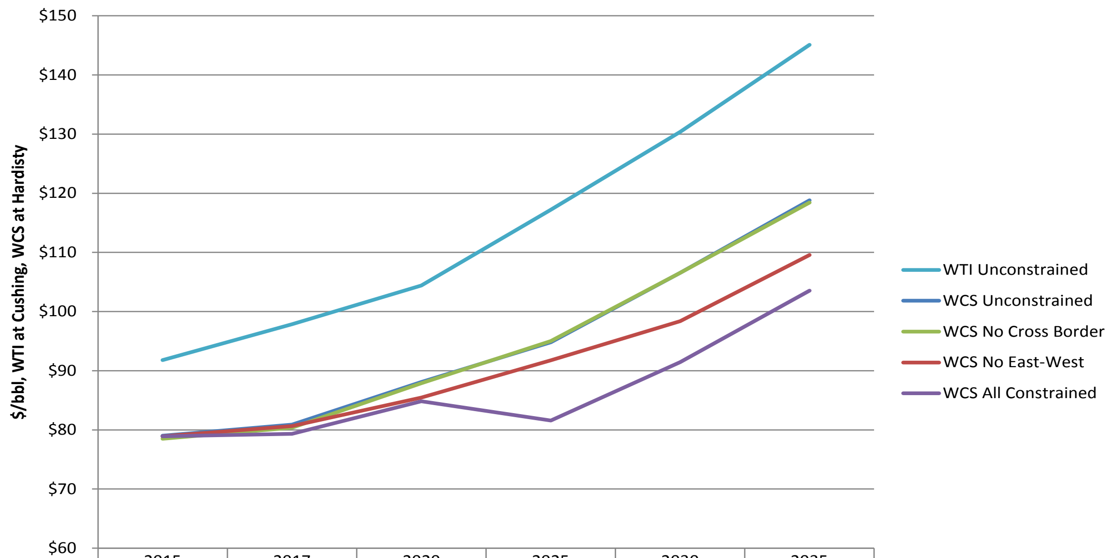
	2015	2017	2020	2025	2030	2035
WTI Unconstrained	$87.18	$88.09	$92.92	$100.20	$111.79	$124.68
WCS Unconstrained	$75.64	$76.21	$80.20	$85.73	$92.59	$100.91
WCS No Cross Border	$75.53	$76.05	$79.97	$84.31	$90.63	$100.54
WCS No East-West	$75.64	$75.93	$78.41	$76.78	$82.12	$92.54
WCS All Constrained	$75.64	$75.49	$75.17	$71.37	$79.07	$89.21

Low/No Net Imports Case - WCS Prices by Pipeline Scenario



	2015	2017	2020	2025	2030	2035
WTI Unconstrained	$86.48	$86.42	$89.71	$95.39	$105.66	$116.43
WCS Unconstrained	$75.02	$74.82	$77.51	$81.05	$85.78	$93.45
WCS No Cross Border	$74.87	$74.66	$77.18	$79.96	$84.84	$92.48
WCS No East-West	$75.00	$74.53	$75.57	$72.80	$76.76	$85.42
WCS All Constrained	$75.00	$74.13	$71.77	$67.52	$73.41	$81.65

High Latin America Case - WCS Prices by Pipeline Scenario



	2015	2017	2020	2025	2030	2035
WTI Unconstrained	$91.80	$97.85	$104.40	$117.23	$130.37	$145.08
WCS Unconstrained	$79.01	$80.87	$88.09	$94.80	$106.56	$118.81
WCS No Cross Border	$78.49	$80.36	$87.88	$95.01	$106.55	$118.43
WCS No East-West	$78.92	$80.64	$85.46	$91.76	$98.36	$109.55
WCS All Constrained	$78.92	$79.33	$84.84	$81.56	$91.46	$103.52

Reference Case - U.S. Average Wholesale Regular Gasoline Prices ($/gal)

	2015	2017	2020	2025	2030	2035
Unconstrained	2.51	2.61	2.76	2.94	3.17	3.53
No Cross Border	2.51	2.60	2.75	2.94	3.16	3.53
No East West	2.51	2.61	2.75	2.94	3.16	3.52
Constrained	2.51	2.62	2.75	2.94	3.16	3.52

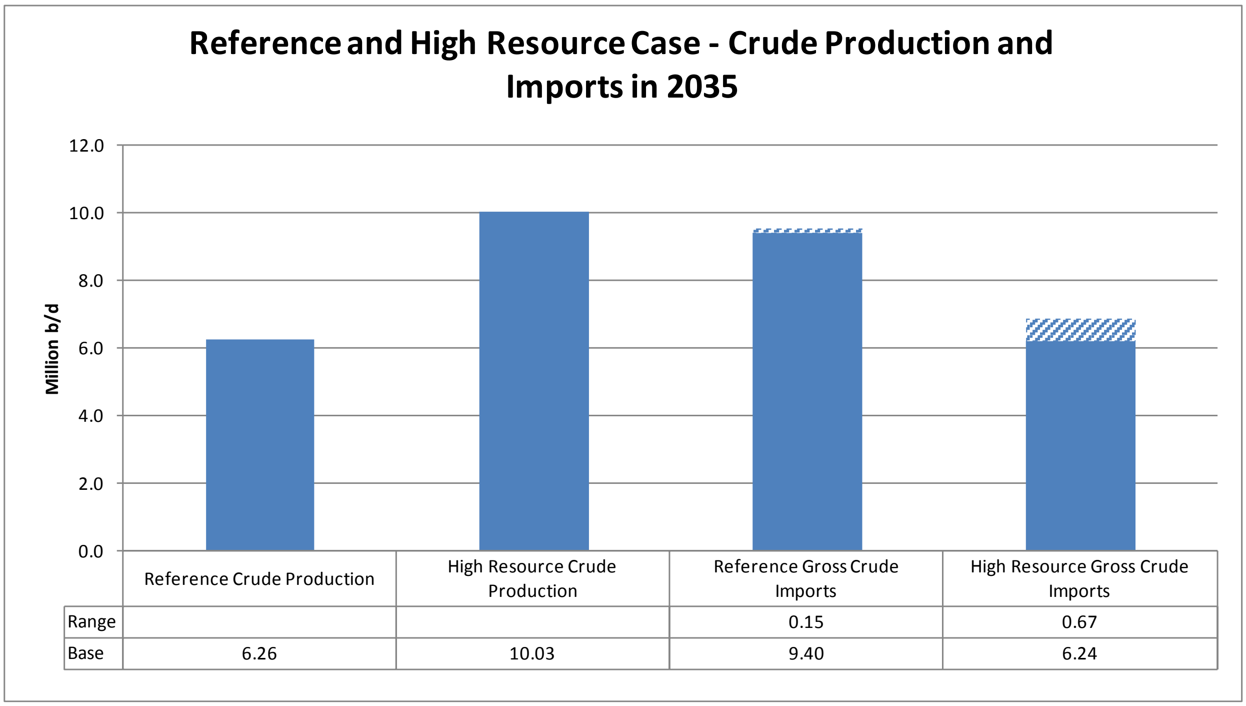
High Resource Case - U.S. Average Wholesale Regular Gasoline Prices ($/gal)

	2015	2017	2020	2025	2030	2035
Unconstrained	2.41	2.45	2.54	2.67	2.87	3.16
No Cross Border	2.40	2.45	2.54	2.68	2.87	3.16
No East West	2.41	2.46	2.53	2.67	2.86	3.16
Constrained	2.41	2.46	2.53	2.67	2.86	3.16

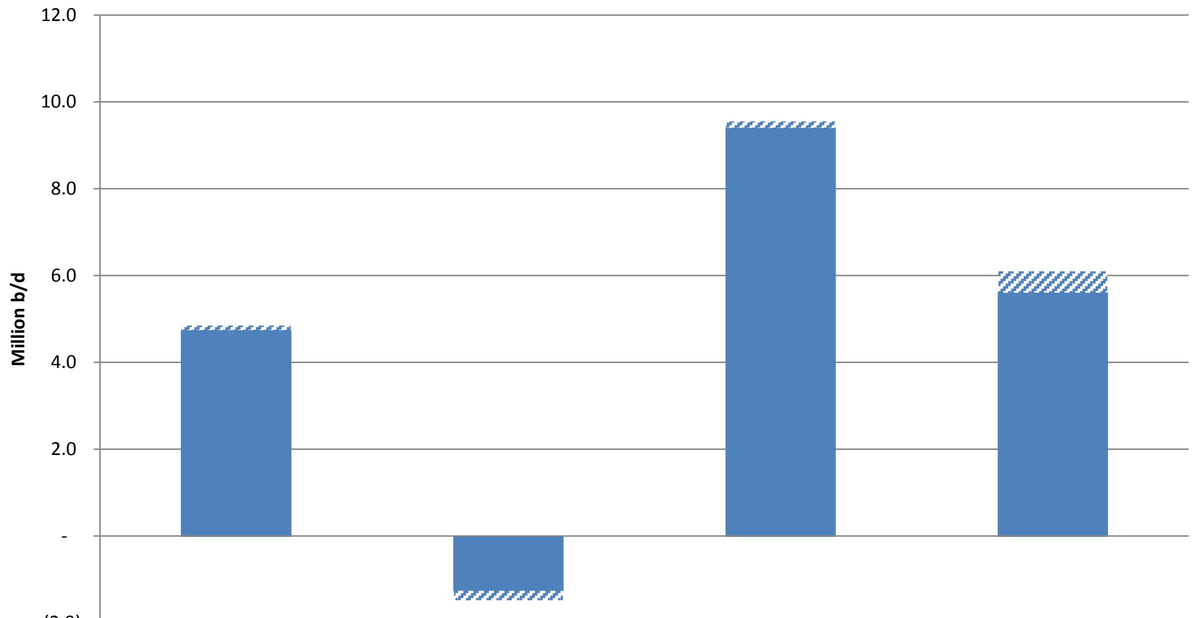
Low/No Imports Case - U.S. Average Wholesale Regular Gasoline Prices ($/gal)

	2015	2017	2020	2025	2030	2035
Unconstrained	2.37	2.37	2.41	2.50	2.63	2.87
No Cross Border	2.37	2.37	2.41	2.50	2.63	2.87
No East West	2.38	2.37	2.41	2.50	2.63	2.88
Constrained	2.38	2.37	2.41	2.50	2.63	2.87

High Latin America Case - U.S. Average Wholesale Regular Gasoline Prices ($/gal)						
	2015	2017	2020	2025	2030	2035
Unconstrained	2.52	2.62	2.67	2.94	3.18	3.53
No Cross Border	2.51	2.61	2.67	2.94	3.17	3.52
No East West	2.52	2.63	2.66	2.94	3.16	3.51
Constrained	2.52	2.63	2.66	2.94	3.16	3.52



Reference and Low/No Net Imports Case - Crude Production and Imports in 2035



	Reference Net Liquid Fuel Imports	Low/No Net Liquid Fuel Imports	Reference Gross Crude Imports	Low/No Gross Crude Imports
Range	0.10	(0.22)	0.15	0.49
Base	4.7	(1.3)	9.40	5.61

ATTACHMENT 7, EMAIL CORRESPONDENCE

From: Balaux, Kyle
Sent: Sunday, October 27, 2013 5:09 PM
To: Brakke, Michael T
Subject: Re: sourcing CIBC analyses

Hi mike,

I have received responses from those concerned with the use of cibc research. You are free to use the data/quotes as described below. Please let me know if there are any questions.

Kyle

From: Brakke, Michael T
Sent: Wednesday, September 18, 2013 3:12 PM
To: Balaux, Kyle
Cc: Kaliel, Jeremy; Nick.Lupick; Benes, Keith J; Nerurkar, Neelesh
Subject: sourcing CIBC analyses

Dear Kyle,

Thanks again for speaking with us a few weeks ago and for sharing more information about CIBC's supply cost methodology.

Given the usefulness of the information included in your reports and our subsequent correspondence, we are seeking CIBC's permission to use, quote, cite, and/or append certain excerpts in public documents. It is our understanding that under the terms by which CIBC provides those reports (whether to clients, reporters, etc.), the recipient of a report cannot reproduce or further distribute the report in full. With your permission, we would include this email exchange in an appendix to our environmental review documents with numerous other sources, and would cite this, rather than the non-public report itself. It would be helpful to get your permission to use the following excerpts/citations:

- Reference in text or tables that CIBC's 2012 supply cost estimates for Canadian projects range from $43.47-81.75/bbl for SAGD, $66.96-75.89/bbl for mining, and $83.30-92.56/bbl for integrated mining and upgrading in WTI terms.
    - CIBC's ranges are for different levels of Western Canadian Select discounts (15-25%) and synthetic crude oil discounts (0-10%) to WTI. SAGD ranges include low, average, and high cost SAGD projects. The range for average SAGD projects was $56.02-$63.49. CIBC's 2013 report omitted the smaller discounts and the integrated projects; the remaining estimates were largely the same.
    - [Note: CIBC estimates may be combined with other estimates to create tables/figures that express averages or ranges of industry supply costs and/or express them in terms of alternative benchmarks or supply costs for bitumen at the plant gate. Where provided, conversions will be made using internally consistent methodologies.]
- Note that diluent costs are incorporated into referenced oil sands supply cost estimates, but sources employ different methodologies to model their price (e.g., the size of diluent's premium relative to light, sweet crude oil) and account for their purchase. Reference that CIBC's methodology is to explicitly account for the fact that some of the costs associated with purchasing diluent are at least partially recovered in revenues from their sale in a heavy oil blend, while some other sources treat diluent as an input cost and do not separately model the revenues attributable to it in the sale of the resulting blend.
- We would like to quote some combination of the following text about project rationalization and production forecasts (from 2013 report, except where specified otherwise):
    - "According to our detailed oil sands project database, in aggregate, oil sands producers have independent plans that would lead to oil sands production reaching 5 MMbbl/d by 2020 (vs. CAPP forecasts of 3.2 MMbbl/d) – a completely unrealistic scenario. As no producer willingly gives up the quest for growth, some degree of project rationalization will be required and will be dictated by market forces in the form of inflation, lower pricing (due to transportation bottlenecks), inability to finance or some combination of all these factors. This continues to highlight a competitive backdrop in the oil sands" (page 5).

    - "Clearly, it is unrealistic to consider that oil sands production will reach 5 MMbbl/d by 2020; there are a number of projects in this estimate that are wildly optimistic and completely unfunded. However, when we risk each project in our project database according to financing ability and project quality, we still reach a risked level of 4 MMbbl/d by 2020, which comprises production from high-quality resources from high-quality developers. This growth level is only achievable to the extent that adequate cost-effective transportation is built (pipeline or reasonable-cost rail) and inflation is held in check. To the extent that infrastructure bottlenecks continue and/or hyper-inflation emerges, growth would be restrained. Our downside view (i.e., infrastructure constraints and inflation forcing cancellation of some reasonable-quality projects) still forecasts growth in the 3.0 MMbbl/d–3.5 MMbbl/d range by 2020 (which is in line with CAPP's base-case view)" (page 5).
    - "After applying our detailed risking, we still generate very aggressive oil sands growth projections. The CIBC risked case forecasts oil sands production increasing from 1.8 MMbbl/d in 2012 to 4.2 MMbbl/d in 2020 (297,000 Bbls/d) per year growth. Despite a more detailed approach to risking, our current forecasts are in line with our forecasts a year ago. Compared to CAPP's forecasts, the risked production potential we foresee is ~383,000 Bbls/d higher in 2016 and 1 MMbbl/d higher in 2020" (page 46).
    - CIBC (2012) notes that project rationalization happened before and will happen again, for the oil sands and other parts of the oil industry: "In an efficient market, price or costs will rationalize the supply/demand balance – and oil sands is no exception. As recently as the 2005-2008 cycle, we saw inflating costs substantially rationalize the pace of planned oil sands development – and we will see that again" (page 90)
- We would like to reference that CIBC (2012) estimated the growth in the labor market that would be required to meet the needs of announced projects: "with so many projects in the queue, the labor needs are still massive…The key takeaway is that to meet industry growth forecasts to the 2016/17 time frame, the available labor force in the oil sands would need to expand approximately 80% from 2012 levels" (page 88-89).
- We would like to reference CIBC's estimate of industry cost inflation: CIBC (2013) notes that while "there has been record oil sands spending over the past two years, particularly for SAGD projects, inflation appears to be running <5% (which is line with our forecast) and a level that would still allow very robust oil sands growth" (page 46).
- Reference that relatively lower-cost in-situ production accounts for 70% of CIBC's risked production growth (2013, page 47).
- Quote CIBC's perspective on the industry's potential for technological change: "There is unprecedented R&D going on in the oil sands, aimed at improving the economics and environmental footprint. Technologies range from evolutionary to revolutionary and any success could have a meaningful impact on supply costs – similar to how frac technology changed the game for tight oil. Oil sands continue to offer a significant 'free option' on technology" (2012, page 6).
- Note CIBC's (2013) comparison of the economics of oil sands and tight oil plays:
    - According to CIBC (2013), "high quality oil sands resources can easily compete with LTO [light tight oil]" . CIBC goes on to say that "The oil sands are often considered a fairly homogenous resource, but that really couldn't be further from the truth – particularly in the world of in-situ oil sands where there are vast differences in terms of quality. The challenges facing oil sands will no doubt impact some growth plans (as we noted earlier, corporate expectations are wildly optimistic), but by way of natural selection they will hit the lowest-quality and most underfunded resources the hardest. High-quality in-situ

resources compete very well in rate of return with even the most economic LTO plays and have the advantage of resource longevity" (page 51).

  - CIBC (2013): "For investors, capital spending profiles (particularly for small- and mid-cap players) are important considerations. Being a mid-cap oil sands producer facing a $1 billion-$2 billion sanction decision is far different than an equivalent-sized LTO producer sanctioning next month's drilling activity. The shorter cycle times and smaller capital exposures give LTO producers a big advantage, particularly in a volatile pricing environment" (page 53).

- We would like to quote CIBC's evolving perspective on rail's potential: "Increases in rail movements of crude oil have been among the biggest changes since our report last year, effectively moderating our thinking of the "worst-case scenario" from one in which lack of pipeline infrastructure forces a massive cannibalization/curtailment of anticipated oil sands growth to one that foresees rail stepping in to accommodate some of the excess transportation needs. As rail is higher cost (and fees are unregulated and more prone to inflationary pressures), there is still likely to be some significant project cannibalization but of a less severe nature than we anticipated a year ago" (2013, page 60)

Thanks again, and please contact us if you have any questions.

Michael T. Brakke
U.S. Department of State
Bureau of Energy Resources (ENR/EGA/PAPD)

From: Greg Molaro
Sent: Tuesday, September 10, 2013 4:03 PM
To: Benes, Keith J
Subject: RE: Confirming Altex Information

Sincerely,
Greg Molaro

From: Benes, Keith J
Sent: Tuesday, September 10, 2013 12:22 PM
To: Greg Molaro
Subject: RE: Confirming Altex Information

Greg,

Thanks for the rapid response. I just want to make sure we have this correct, b/c I think I created some confusion with terminology. The "WCSB" heading was meant to refer to Western Canadian Sedimentary Basin (apart from the Bakken region), rather than "WCS," Western Canadian Select. What you have clarified, is that the estimated capacities for all of your facilities (apart from Wainwright) are not for a WCS/dilbit type crude; but rather, for an undiluted/under diluted bitumen (either raw bitumen or railbit). Correct? *Yes.*

Our loading estimates generally note a WCS/dilbit loading capacity (with assumed diluent content of approximately 30%, which is what we see most commonly cited as a common diluent content for pipeline-spec dilbit). We would be sure to note that the estimates Altex provides are, in fact, for raw bitumen or railbit. *The 30% diluent you refer to is the winter spec for Enbridge Pipeline and only for very heavy crudes (~8-10 API).*

Thank you, again.

Keith

This email is UNCLASSIFIED.

From: Greg Molaro
Sent: Tuesday, September 10, 2013 2:03 PM
To: Benes, Keith J
Subject: RE: Confirming Altex Information

Sincerely,

Greg Molaro

From: Benes, Keith J
Sent: Tuesday, September 10, 2013 9:27 AM
To: Greg Molaro
Cc:
Subject: Confirming Altex Information

Greg,

Thanks again for taking the time a few weeks ago to speak with me about Altex Energy's crude by rail loading terminal locations and capacities. As discussed during that call, we are following up with you via e-mail to confirm some of the information discussed. Please note that our intent is to include this email correspondence in the appendix of sources (along with others) that would be published as part of the Final SEIS for the Keystone XL Pipeline project.

We would appreciate it if you would confirm or verify the following information:

- By year-end 2011 Altex Energy's Lloydminster (SK) and Lashburn (SK) terminals were operational with an estimated crude loading capacity of 15,500 bpd.
- By year-end 2012 the Lloydminster (SK), Lashburn (SK), and Unity (SK) terminals were operational with an estimated crude loading capacity of 40,000 bpd.
- Currently, the Lloydminster (SK), Lashburn (SK), Unity (SK), Wainwright (AB), and Lynton (AB) are operational with a capacity of 70,000 bpd.
- We are hoping you could also confirm or verify the information presented in the table below regarding existing and planned facilities/expansions.

Facility/Owner Operator	Capacity (bpd)	Operational/Year	WCSB or WCSB-Bakken
Altex Energy, Lloyminster, SK	3,000	Operational	Bitumen
Altex Energy, Unity, SK	19,000	Operational	Bitumen
Altex Energy, Lashburn, SK	30,000	Operational	Bitumen
Altex Energy, Lynton, AB (to MS)	12,000	Operational	Bitumen
Altex, Wainwright, AB	6,000	Operational	WCSB
Altex Energy, Lynton, AB (Expansion)	8,000	2013	Bitumen
Altex Energy, Lashburn, SK (Expansion)	30,000	2013	Bitumen
Altex Energy, Falher (Peace River), AB	20,000	2013	Bitumen
Altex Energy, Reno (Peace River), AB	22,000	2014	Bitumen
Altex Energy, Reno (Peace River), AB	38,000	Under Development	Bitumen

Note: Bitumen is converted into WCSB by adding oil and condensate ("diluent") to the bitumen. That process makes the dilbit pipeline ready. Typically, about 18-20% of a WCSB bbl is diluent. Hence, if your model scores everything as WCSB, then you should add 20% capacity to the Bitumen values above.

- And finally, could you also confirm the estimated cost range for operating a Diluent Recovery Unit (DRU)? You had provided an estimated cost of $3-4 per barrel of diluent recovered and we would appreciate your confirmation or verification of that cost range. *Yes, this is the correct operating cost range for a DRU. If takes about .75 mmbtus per bbl of dilbit and the remainder of the operating costs are electrical (pumps, heat trace, etc.). Please understand, it is uneconomic to try and get all the diluent out of the bitumen. The economics above are predicated on the removal of 90-95% of the diluent. 5-10% of the diluent remains with the oil. Hence, there is still an economic cost in the form of a loss of diluent ~2% that goes with the bitumen. With diluent selling for a WTI type price ($100 per bbl), that loss is about $2.00 per bbl!*

Thanks again for your assistance in this matter, Greg. We look forward to hearing back from you.

Regards,

Keith J. Benes
Attorney-Adviser
U.S. Department of State

This email is UNCLASSIFIED.

From: Jarrett Zielinski
Sent: Tuesday, September 10, 2013 1:14 PM
To: Benes, Keith J
Cc:
Subject: Re: Confirming Torq Information

Hi Keith,

Please see my comments below in RED.

On Tue, Sep 10, 2013 at 10:02 AM, Benes, Keith J < > wrote:

Jarrett,

Thanks again for taking the time a few weeks ago to speak with me about Torq Transloading's crude by rail loading terminal locations and capacities. As discussed during that call, we are following up with you via e-mail to confirm the information discussed. Please note that our intent is to make this email correspondence publicly available by including it in the appendix of sources (along with others) for the Final SEIS for the Keystone XL Pipeline project.

We would appreciate it if you would confirm or verify the following information and estimated capacities:

- By year-end 2011 the Dollard (SK) facility was Torq's only operational facility (subsequently sold to another operator). The year-end nameplate capacity in 2011 of this facility was 12,000 bpd. Correct

- By year-end 2012, Torq operated six facilities operational with a combined estimated nameplate capacity of approximately 90,500 bpd. (?) Please do note that both Tilley and Lloydminster are CP Rail sites that Torq operates on behalf of CP Rail. Any more detailed information on either of those sites would need to be sourced from CP as we are not in a position to make comments on them.

- We are hoping you could also confirm or verify the information presented in the table below regarding Torq's existing and planned facilities/expansions:

Facility/Owner Operator	Capacity (bpd)	Operational/Year	WCSB or WCSB-Bakken
[redacted]			
Torq Transloading/CN, Unity, SK	20,000 Correct, expansion to	Operational	WCSB

	be complete in November 2013 and will be able ship unit trains on both CN and CP. Site has a daily limit restricted to approximately 50,000 bpd on account of trucking levels.		
Torq Transloading, Instow, SK	15,000	Operational	WCSB
Torq Transloading, Lloydminster, SK	20,000	Operational	WCSB
Torq Transloading, Whitecourt, AB This is a CN site that Torq operates on behalf of CN.	3,500 Construction is currently underway to expand this terminal to 13,500 bpd. Expected to be complete next week	Operational	WCSB
Torq Transloading/CN, Unity, SK	50,000	2013	WCSB
Torq Transloading, Kerrobert, SK	140,000	2014	WCSB
[redacted]			
Torq Transloading, Bromhead/Southall, SK	13,000 Expandable to 50,000 bpd	Operational	WCSB-Bakken

Torq Transloading Sexsmith AB - 23,000 bpd - Operational Q2 2014 - WCSB

Thanks again for your assistance in this matter, Jarrett. We look forward to hearing back from you.

Regards,

Keith J. Benes

Attorney-Adviser

U.S. Department of State

This email is UNCLASSIFIED.

--
Kind Regards,

Jarrett Zielinski
President & CEO
Torq Transloading

http://torqtransloading.com/

This email is UNCLASSIFIED.

From: Murti, Arjun
Sent: Friday, August 23, 2013 3:13 PM
To: Brakke, Michael T
Cc: Benes, Keith J; Nerurkar, Neelesh
Subject: RE: sourcing Goldman Sachs analyses

Michael, I have received all the sign-offs from my end to give the permissions noted below. Please find replies in blue below and please let me know if you need anything else. Regards, Arjun

Arjun N. Murti
Goldman, Sachs & Co.

From: Brakke, Michael T
Sent: Wednesday, August 21, 2013 7:34 PM
To: Murti, Arjun [GIR]
Cc: Benes, Keith J; Nerurkar, Neelesh
Subject: sourcing Goldman Sachs analyses

Arjun,

Thanks again for taking the time to talk with us the other day. Very helpful, as always.

Following up on our conversation about sourcing Goldman Sachs analyses, we are seeking confirmation of your permission to use, quote, cite, and/or append certain excerpts. It is our understanding that under the terms by which Goldman Sachs provides those reports (whether to clients, reporters, etc.), the recipient of a report cannot reproduce or further distribute the report in full. For our purposes, it would be helpful to get your permission to use the following excerpts/citations:

1) Top 380 Report:
    a. Append Exhibit 254: the top 380 cost curve in detail (p. 169). Please let us know if you'd prefer to send an alternative exhibit that only includes the costs for Canadian and U.S. tight oil projects. I can do this if you would like, please let me know.
        i. Reference in text or tables that Goldman Sachs supply cost estimates for Canadian projects range from $40/bbl to $136/bbl in WTI terms. Note that Goldman Sachs published supply cost estimates in terms of Brent equivalency, but they are converted to WTI using an assumed differential of $14/bbl. OK
        ii. Goldman Sachs estimates may be combined with other estimates to create tables/figures that express averages or ranges of industry supply costs. OK
    b. Append Exhibit 47: unconventional liquids cost curve (p. 31).
        i. Reference to the range of costs for different plays in the text. OK.
    c. We would like to use the following quote to explain your definition of breakeven price: "The oil price required for a project to generate what we consider to be a commercial rate of nominal IRR (i.e. cost of capital). We assume geography determines this rate of return with projects in the OECD requiring 11% up to a maximum of 15% in countries

which we deem to be higher risk" (page 131). Note that Goldman Sachs assumes that investments in Canada, as an OECD country, require the lower rate of return. OK

d. Note that Goldman Sachs states that higher costs have made some oil sands projects less competitive: "Data points that indicate higher costs for SAGD greenfields (such as Japex's Hangingstone, sanctioned in 2012 for an implied US$70,000 per flowing barrel) as well as our assumptions for higher maintenance capex have led to deterioration in the curve from last year's report. If we run the curve taking into account 2012 Brent-heavy spreads, the picture becomes even more worrying" (page 36). OK

2) Getting Oil out of Canada

a. We would like to use the following quote: "While we see significant demand for Canadian heavy crude oil in the United States, in particular in the Gulf Coast region, the main question at this time is whether sufficient pipeline takeaway capacity will exist that crosses the Canada/ US border, with Keystone XL (TransCanada) and Alberta Clipper (Enbridge) the key projects to watch, in our view (Exhibits 1-4). In the event that either the Keystone XL newbuild or Alberta Clipper expansion (or both) encounter further delays, we believe risk would grow that Canadian heavy oil/oil sands supply would remain trapped in the province of Alberta, putting downward pressure on WCS pricing on both an absolute basis and versus WTI" (page 2).

i. Over the phone you mentioned that this analysis has been occasionally misinterpreted and we would welcome any written clarification you might wish to provide about the report's conclusions, the audience it was intended for, and your views on the outlook for oil sands production and rail transportation. On the quote, environmental groups mis-interpreted/mis-portrayed the quote to imply a permanent halting of oil flows. That is not what we meant. We are referring to the risk of project delays/deferrals until alternate transportation modes are built (i.e., a different pipeline or new rail capacity). The word "trapped" was meant as a shorter-term consideration. We believe crude oil production in Canada will grow for many years/decades into the future given the size of the resource and expected resource development economics. However, if Keystone XL and other key near-term pipeline projects face further delay, there is a risk some projects could get pushed out in time.

ii. Do you view the risk of supply remaining trapped as more of a long-term, or short-term risk? I think answer directly above clarifies this.

iii. Goldman Sachs's outlook for WCS prices was left unchanged for 2013, $4.75/bbl lower for 2014, and only $1.90/bbl lower for 2015 as a result of the report's reassessment of the oil sands operating environment (page 4); Goldman Sachs's outlook for the WCS differential to WTI grew by an equivalent amount. Differentials routinely change by much larger amounts due to relatively small changes in supply or demand. OK/correct.

iv. Comparing your Base case to the Bear scenarios, it seems in both scenarios the WCS discount to Maya settles out to be equal to the cost of transport from Western Canada by Q4 2015. In the Base case, where you assume pipeline capacity becomes available at that time, the discount is $13/bbl in Q4 2015, which is your estimate of the all-in pipeline transport cost from Alberta to the Gulf Coast. In the Bear case, where you assume higher production and slower development of rail over the next two years (as compared to the Base case, Page 25), there are deeper discounts on WCS versus WTI/Maya (particularly through 2014). These deeper discounts would further incentivize the development of rail facilities, and the report has the price discount of WCS versus Maya at $20/bbl, which is your estimate of all-in rail transport costs from Alberta to the Gulf Coast (page 25). Ok/Correct

   v. On page 15 the report mentions the estimates on rail capacity in Western Canada that were taken into account in the report's conclusions, by this are you referring to loading capacity at facilities in Western Canada, or other factors that might cap capacity (such as availability of rail cars)? This refers to the entirety of the rail logistics chain…clearly rail loading facilities in Western Canada, rail cars, and rail offloading facilities at/near refineries in the US are all needed. The timing, scope, cost, and magnitude of the investments clearly has a high degree of uncertainty, though the Bakken experience gives confidence that meaningful rail logistics infrastructure can be ramped up with 12-36 months. Would those capacity estimates be influenced by the various announcements of new unit-train facilities that were made around Q2 earnings reporting time (such as Keyera/Kinder Morgan; Gibson/USDG; Torq Transloading; Canexus Bruderheim expansion; etc. If the rate of capacity additions were changed, would that impact the assessment of potential for bottlenecks and/or production shut-in?)

b. Quote: "In the event WCS prices come under pressure, in particular in our bear case scenario, we would expect project delays/deferrals in the out years. While it can be difficult to delay/cancel mining oil sands projects mid-development given the large-scale, long lead time nature of oil sands mining, SAGD projects could more easily get pushed out as individual projects are typically smaller scale than mining, with CAPEX more easily adjusted." (page 7) OK/correct.

3) We would also appreciate it if you could confirm the following points:
   a. It is Goldman Sachs's observation that the entire cost curve for the oil sands rose dramatically from 2003-2008, which was partly attributable to high mining costs and decreases in labor productivity. Yes.
   b. It is also Goldman Sach's observation many of the drivers of inflation have since abated and there haven't been significant changes in oil sands supply costs since 2008. Yes.
   c. Finally, according to Goldman Sachs, one big variable in the reduction of some supply costs is reservoir quality, particularly for SAGD projects. SAGD is not as labor-intensive as mining and especially upgrading, which explains why some cost pressure has disappeared. Yes.

Thanks again, look forward to hearing from you, and please let us know if you have any questions.

Best regards,

Michael T. Brakke
U.S. Department of State
Bureau of Energy Resources (ENR/EGA/PAPD)