

Cushing Canadian Congestion

A Review of Logistics Options

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Overview

- **EnSys background**
- **Today's congestion**
- **Keystone XL**
- **Projects & Options**
 - **Refining**
 - **Pipeline projects**
 - **Non-pipeline potential**
 - Rail, barge/tanker, full upgrading
- **Summary comments**



EnSys Overview

- Strategic issues in U.S. and global refining
- Focus on national and international developments
- Underlying basis is extensive refining experience and modeling



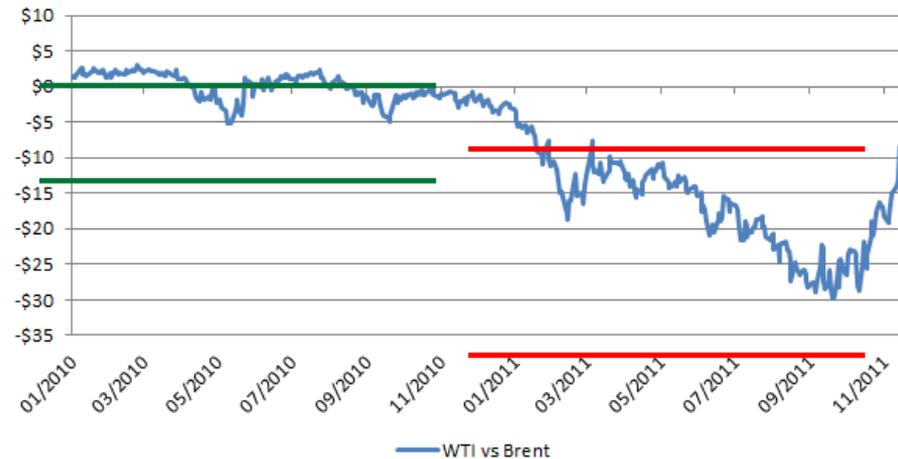
EnSys KXL Analyses (for DOE/DOS)

- **2010 Keystone XL Assessment:**
 - Evaluated alternative pipeline outlooks through 2030
 - Combinations of: KXL, No KXL, No Expansion, Hi/Low Asia
 - Against 2 US petroleum demand outlooks
 - 4 mbd difference by 2030
- **2011 Keystone XL Assessment Update:**
 - Revisited No Pipeline Expansion scenarios
 - Assessed potential for alternative transport modes to move US and Canadian crude oils to markets
- **Studies available at www.ensysenergy.com**

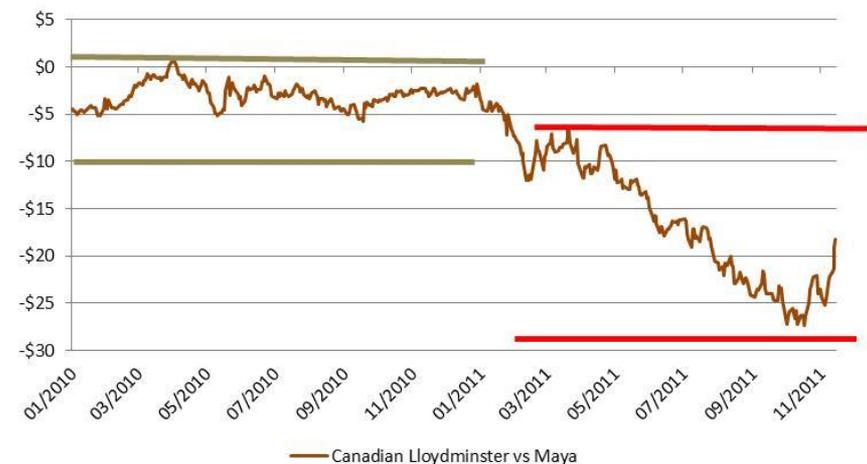
Today: Canadian + Cushing = Congestion

- **In 2011 Cushing congestion has become “structural”**
 - **Line capacity into Cushing well exceeds capacity out**
 - No line south out of Cushing to GC
 - **Midcontinent, Bakken, WCSB etc. supply growth exacerbating broad inland imbalance**
 - Moving target
 - **Result is major crude discounts:**
 - WC heavies
 - WTI
 - And anything that is priced off WTI

Source: Bloomberg
WTI vs Brent - \$/bbl



Canadian Lloydminster vs Maya - \$/bbl

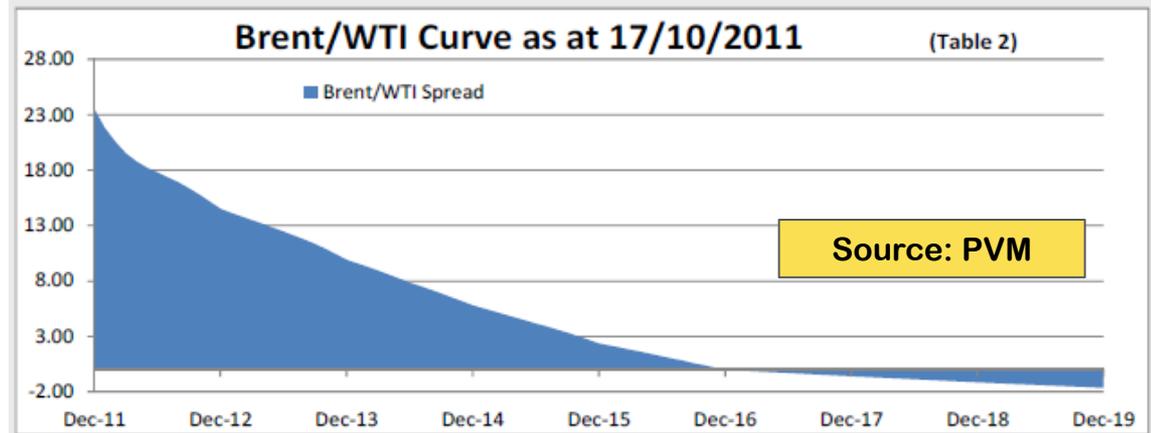


Today: Canadian + Cushing = Congestion

- Brent/WTI spread** arguably a function of

- Perceived time to revert toward parity
- **x Storage costs**
 - ~4½ years *
 - ~\$0.50/bbl per month
 - = ~ \$25/bbl

- **Cost of (inefficient) transport to GC**



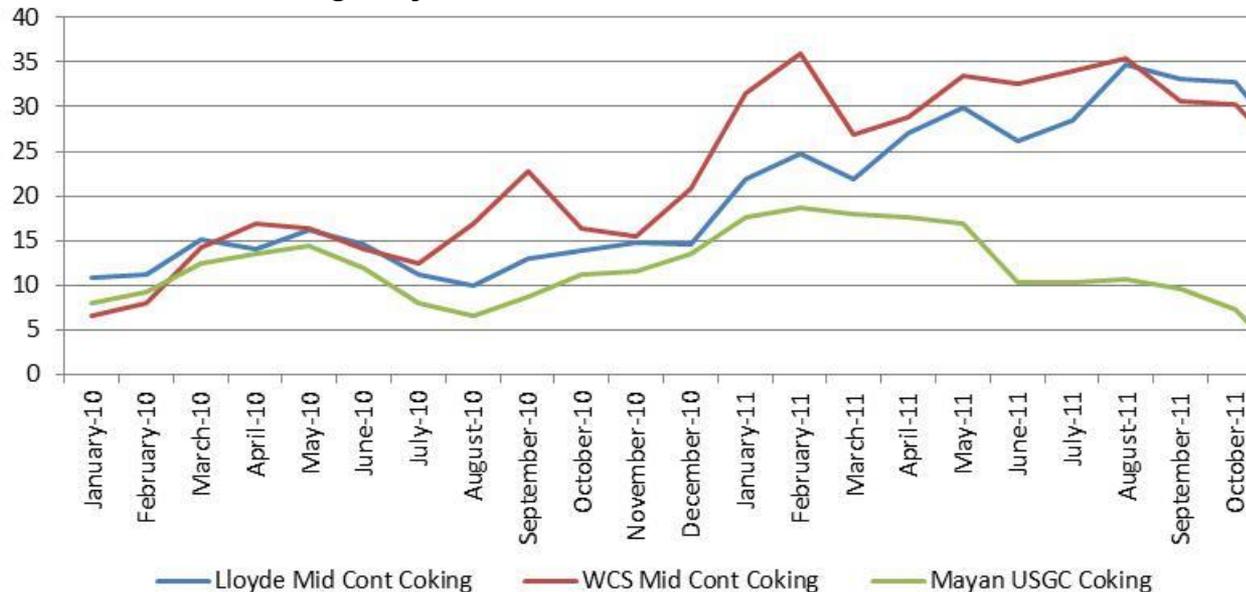
Transportation	Price range
Catoosa (Truck+Barge)	\$12 - \$15
Rail manifest (indirect)	\$8 - \$10
Rail unit train (indirect)	\$6 - \$8
Pipeline	\$2 - \$4
Seaway tariff (north)	\$1.10 - \$1.75

Today: Canadian + Cushing = Congestion

- **US / Western Canada producers losing out**
- **Foreign producers arguably benefiting**
- **Midcontinent refiners benefiting**

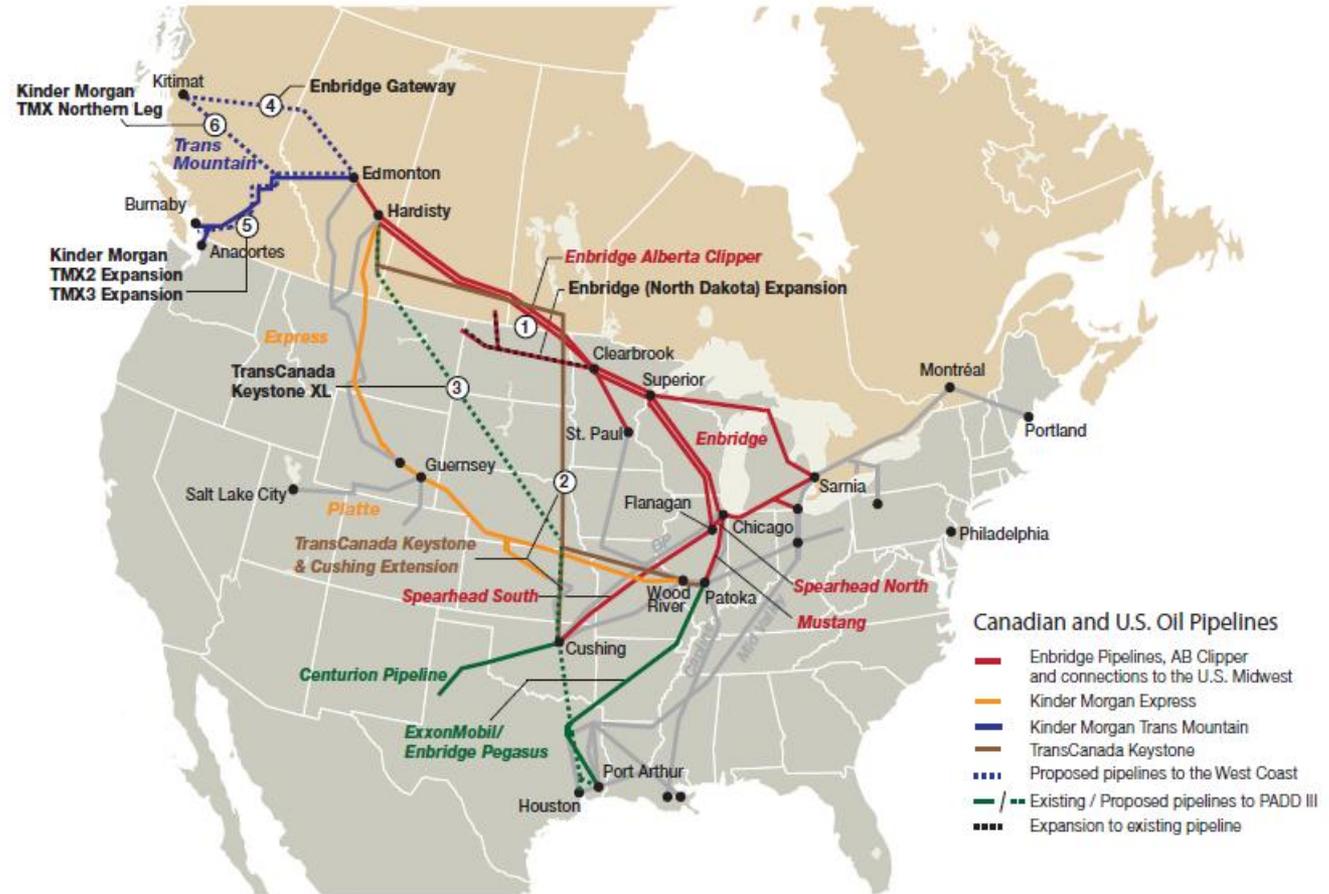
Monthly Refining Margins Coking 1/2010 - 11/2011

Source: Bloomberg EnSys Netbacks



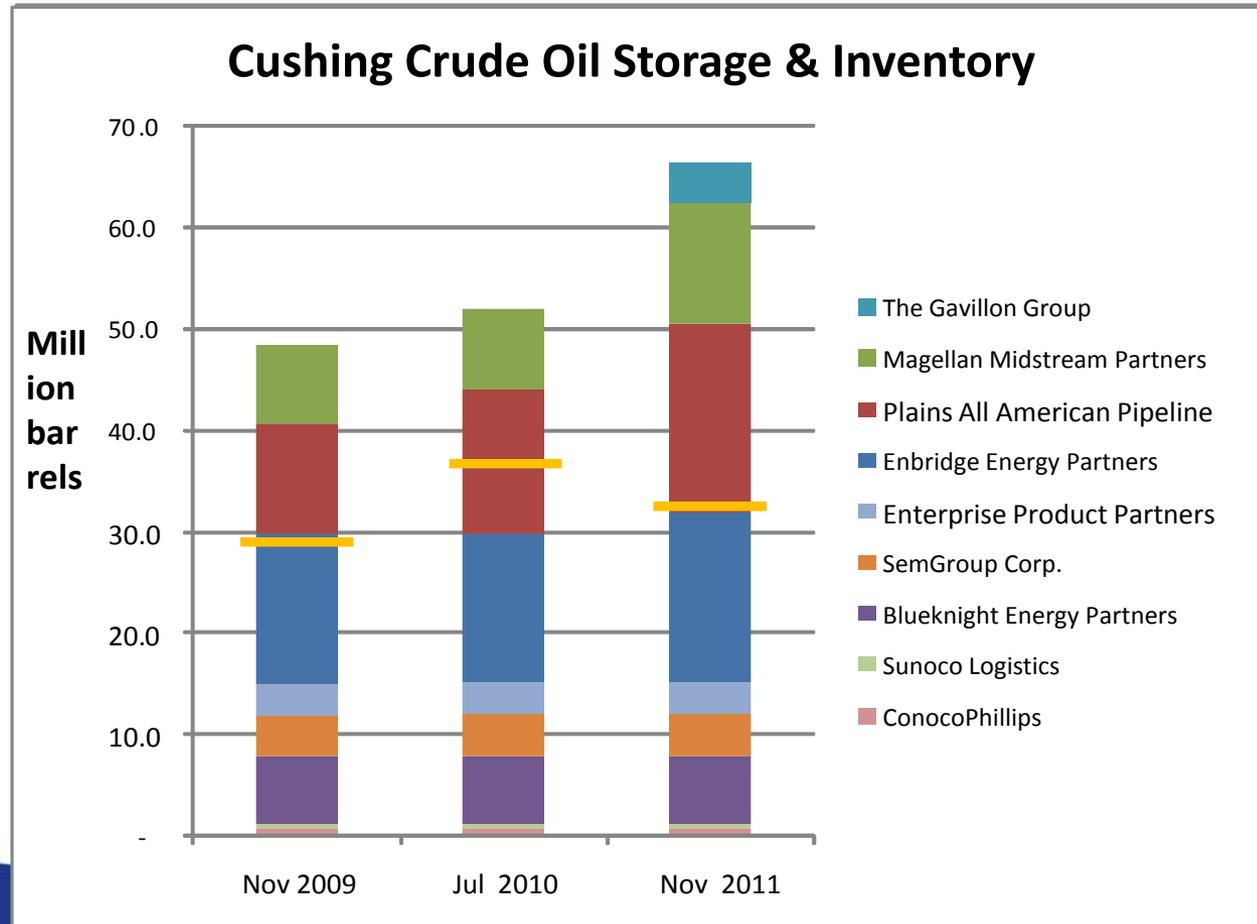
Fundamental Issue : Pipeline Capacity In Exceeds Capacity Out

- System is designed for taking WCSB in to PADD2 and Ecan and US Gulf of Mexico and foreign crudes in to PADDs 2 and 3



Cushing: Storage Companies are Racing to Add Capacity

- **Inventories:**
 - Rose ~0.4 mb per month since 2009
 - Have recently dropped back
- **Increasing total capacity**



Fundamental Issue :

Pipeline Capacity In Exceeds Capacity Out

- **Cushing “I/O” imbalance**
 - **Today severe**

Cushing Pipeline Capacity	mbd		mbd
In:		Out:	
From north/east	0.340	To north/east	0.740
From west	0.950	To west	0.255
From south (Seaway)	0.350	To south	0
Total	1.640	>>	0.995

Fundamental Issue :

Pipeline Capacity In Exceeds Capacity Out

- **Cushing “I/O” imbalance**
 - **Seaway reversal partially alleviates**

Cushing Pipeline Capacity	mbd		mbd
In:		Out:	
From north/east	0.340	To north/east	0.740
From west	0.950	To west	0.255
From south (-Seaway)	0	To south (+Seaway)	0.15-0.40
Total	1.29	≈	1.15-1.45

Fundamental Issue :

Pipeline Capacity In Exceeds Capacity Out

- **Cushing “I/O” imbalance**
 - **Adding Wrangler – Flanagan**

Cushing Pipeline Capacity	mbd		mbd
In:		Out:	
From north/east (+ Flanagan)	0.690	To north/east	0.740
From west	0.950	To west	0.255
From south (-Seaway)	0	To south (+ Seaway & Wrangler)	0.55-1.2
Total	1.64	<	1.55-2.25

Fundamental Issue :

Pipeline Capacity In Exceeds Capacity Out

- **Midwest refining projects will help relieve the pressure on WCSB heavy crudes**
 - But add to that for Lower 48 light sweet
 - And production of both keeps growing

	Impact mbd	Start up
Midwest/Midcont WCSB heavy projects:		
WRB Refining Wood River Illinois	0.130	2011/12
WRB Refining Borger Texas	0.110	2011/12
Marathon Detroit Michigan	0.080	2H 2012
BP Whiting Indiana	0.260	2013
Total	0.580	
MidContinent Debottlenecking	0.100	2011/12



Fundamental Issue : Pipeline Capacity In Exceeds Capacity Out

- Major pipeline projects are needed

Projects to US Gulf Coast	Capacity mbd	Start up
Magellan Longhorn Reversal	0.135/0.225	2013
Seaway Reversal	0.15/0.40	2012/2013
Flanagan / Wrangler Pipeline (Enbridge, Enterprise Product Partners)	Flanagan 0.300 Wrangler 0.800	2Q 2013
Transcanada Keystone XL	0.700	2014??
Transcanada Keystone XL expansion	0.130	2015??
Total to GC	up to 2.2	

Fundamental Issue : Pipeline Capacity In Exceeds Capacity Out

- Major pipeline projects are needed

Projects to British Columbia Coast	Capacity mbd	To BC / Asia	Start up
Kinder Morgan Trans Mountain expansion (1)	up to 0.400	Yes	2015?
Kinder Morgan Trans Mountain Northern Leg	0.400	Yes	uncertain
Enbridge Northern Gateway (2)	0.525	Yes	2017?
Enbridge Northern Gateway expansion	0.275	Yes	Uncertain
Total	up to 1.6		

(1) Open seasons under way 4Q 2011 to gauge level of interest

(2) Application before NEB. Recent open season led to full 0.525 mbpd commitment

Keystone Mainline & XL Projects

Add 1.3 mbd expandable to 1.5 mbd

- **Keystone Mainline (2010, 2011)**
 - Initial 435,000 bpd
 - Expanded to 591,000 bpd & to Cushing
- **Keystone XL (2014??)**
 - **1 permit; 2 construction projects**
 - **new lines from WCSB to Steele City and from Cushing to USGC**
 - Start up 2013 subject to permits
 - 700,000 bpd expandable to 833,000 bpd
 - Committed min 380,000 bpd WCSB to USGC, additional interest
 - **KXL Bakken Marketlink**
 - Intake of Bakken crudes at Baker, Montana
 - **KXL Cushing Marketlink**
 - Offtake of WCSB and intake of MidContinent crudes at Cushing



KXL Focal Point of Political Debate

- **Supporters:**

- Energy security
- Jobs
- Industry supply/refining logic

- **Opponents:**

- Oil sands “bad” GHG footprint
- Damage to boreal forest
- Risk to water supplies Ogallala
- Counter to clean energy goals

- **Status:**

- DOS / Nebraska re-routing delay

- **Environmentalists:**

- Next stop Northern Gateway

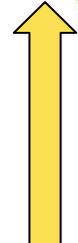
Enbridge Mainline pipeline break, Summer 2010



- 1) Great Lakes
- 2) Lake St. Clair and the St. Clair River
- 3) Indiana Dunes
- 4) Deep Fork Wildlife Management Area
- 5) Native Prairies and the Threatened Topeka Shiner Minnow
- 6) Whooping Crane and Sandhill Crane Habitat
- 7) Ogallala Aquifer
- 8) Prairie Potholes and Migratory Birds
- 9) Shortgrass Prairie and Mountain Plover
- 10) Pronghorn Antelope Habitat

Result is Pipeline Focus & Uncertainty

Refining growth



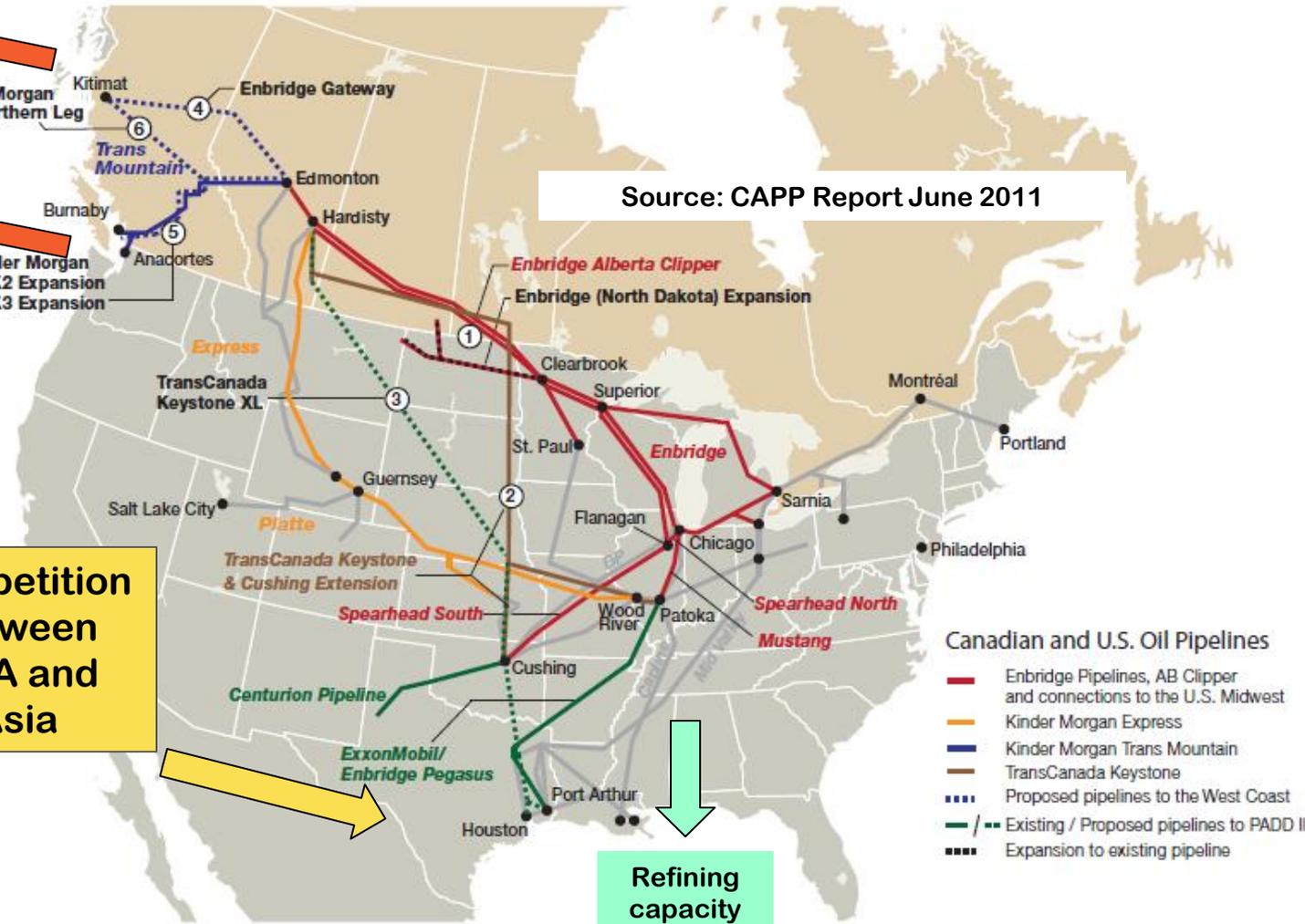
Competition between USA and Asia



Refining capacity

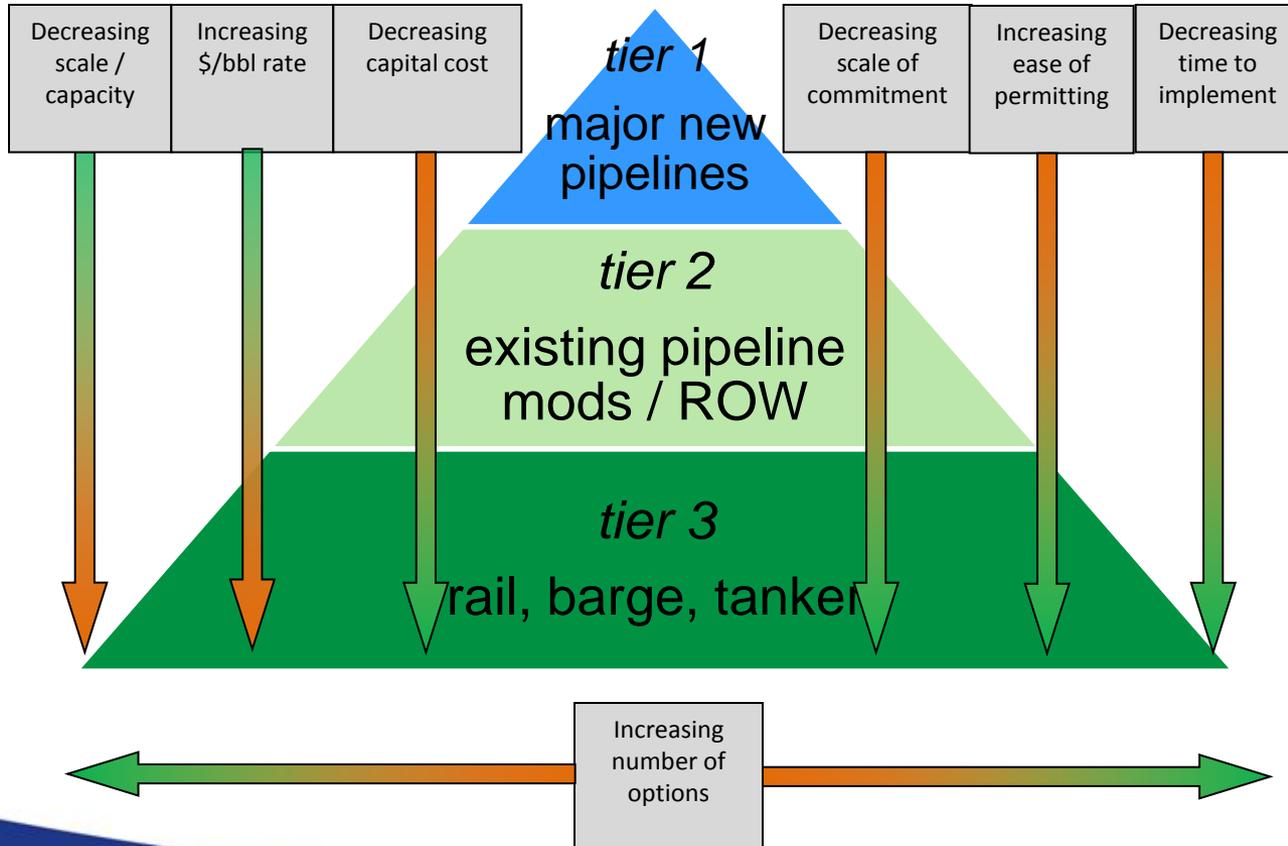


Source: CAPP Report June 2011



What are the Options for Taking Lower 48 and WCSB Crudes to Market if Major Pipeline Projects Constrained?

Effects of Moving from Major New Pipelines to Modifications to Rail/Marine



Rail: Different Economics vs Pipeline

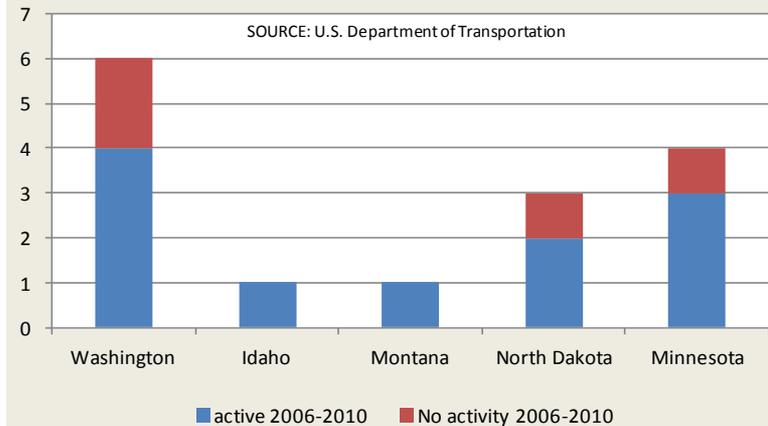
- **\$/bbl rate higher but**
 - Unit trains bring better economics
 - Far lower capital cost / scalable
 - Shorter time to develop (12-18 months)
 - Easier permitting
 - Quicker transit to market
 - Hardisty to GC 8-10 days versus 40 +/- for pipeline
 - Greater flexibility / market destinations
 - Shorter contract terms (0-5 years)
- **Alberta bitumen**
 - Option to move as DilBit or undiluted in heated rail cars
 - Economics comparable to pipeline per bbl bitumen moved
 - Economics can be better if diluent back-hauled



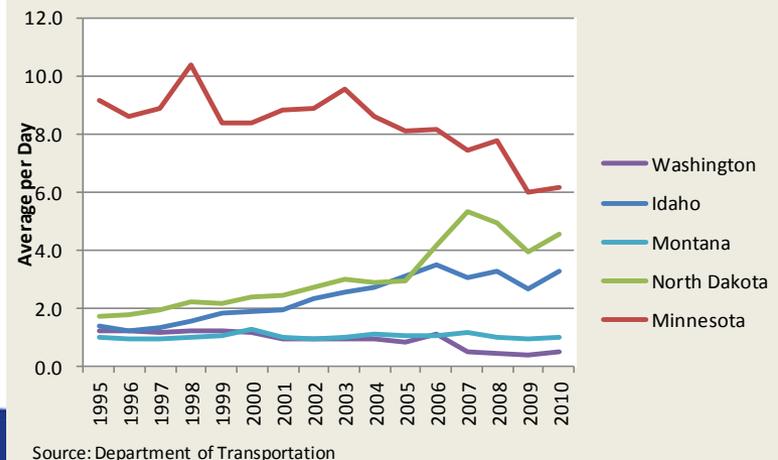
Rail: Available Capacity / Infrastructure

- **US and Canada rail systems**
 - **Infrastructure already built**
 - **Under-utilized post-recession**
 - **Petroleum \leq 2 % of total rail movements**
- **US-Canada cross-border rail crossings**
 - **Oil imports by rail ~110,000 bpd ~70,000 bpd WA - MN**
 - **Significant expansion potential using existing crossings**

**Rail Border Crossings
Washington to Minnesota**



Trains /Day/Active Crossing



Rail: Rapid US Expansion

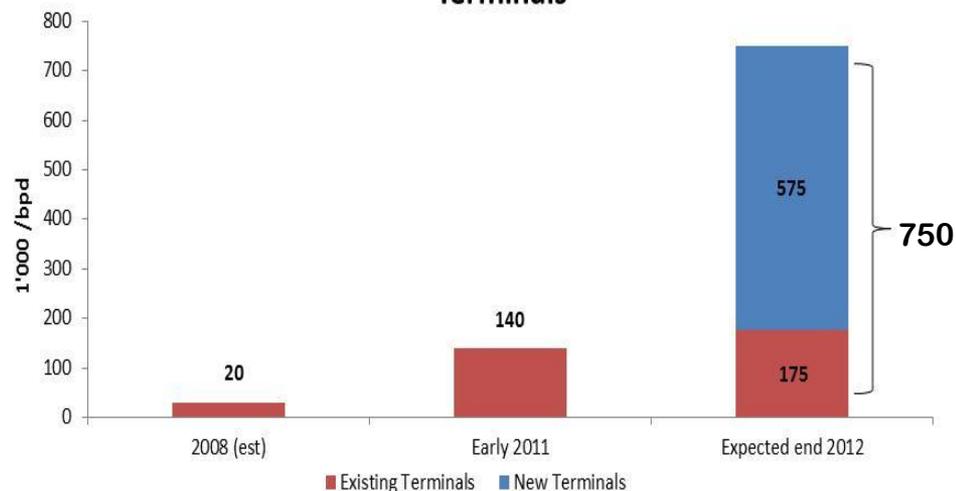
- **Dramatic Bakken increase illustrates potential**

- **Takeaway capacity expanding at 250,000+ bpd per annum**
- **Large & small companies involved:**
 - Hess, Kinder Morgan, BNSF, Enbridge, NuStar *et al*

- **Expanding destinations / receiving capacity:**

- **GC: St. James, Port Arthur**
- **WC: Tesoro, California**
- **Cushing: Stroud, OK**
- **EC: Global Albany NY to barge**

Bakken Rail Takeaway Capacity - Existing and New Terminals



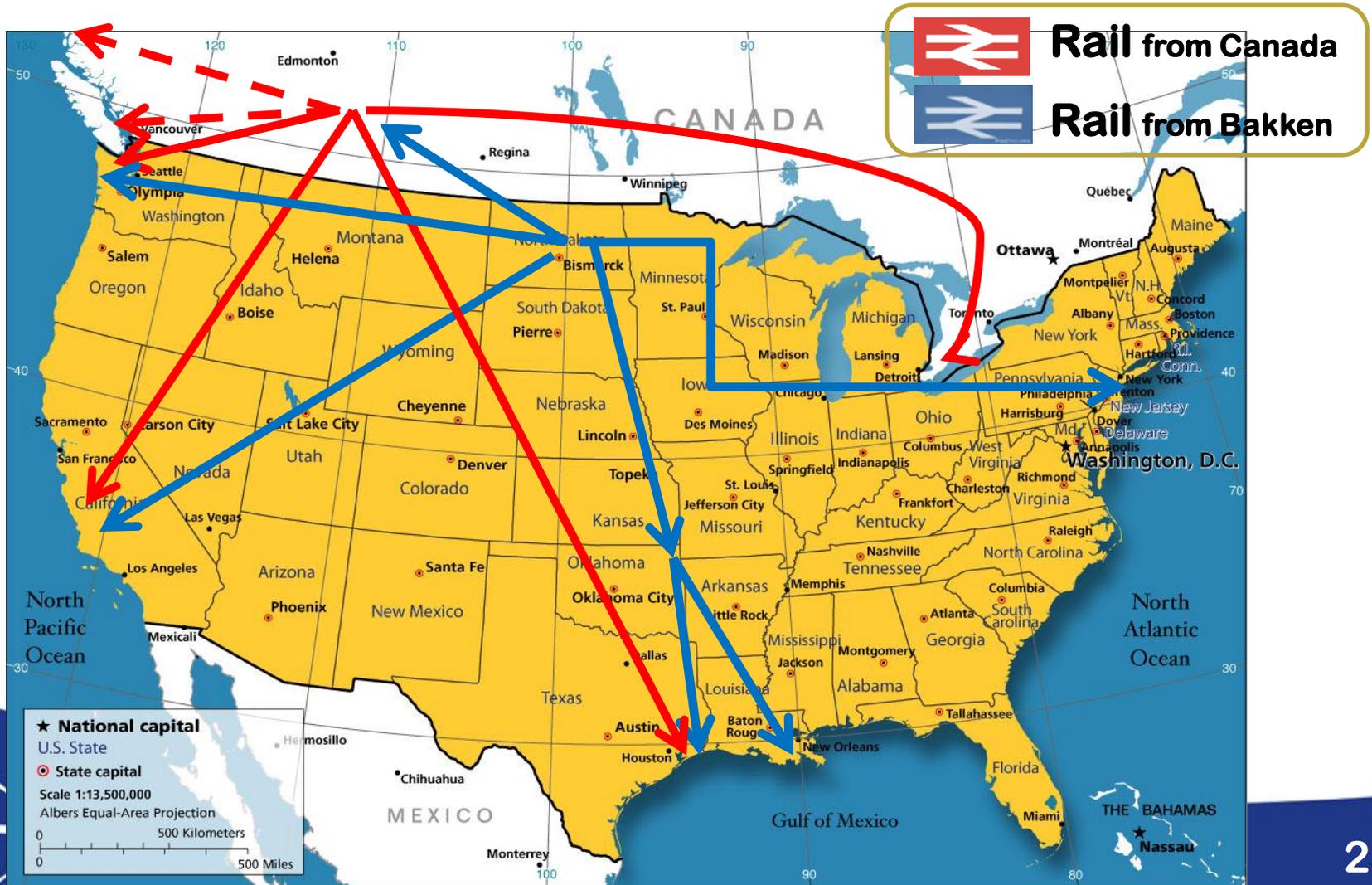
Source: North Dakota Pipeline Authority & Musket Corporation

Rail: History & Potential in Canada

- **History of rail movements ~100,000 bpd**
- **CN Rail and Canadian Pacific now actively investing**
- **WCSB crude already being shipped to:**
 - Gulf Coast
 - Washington
 - California
 - Ontario
- **Potential to expand to BC Coast:**
 - Vancouver
 - Kitimat
 - Port Rupert

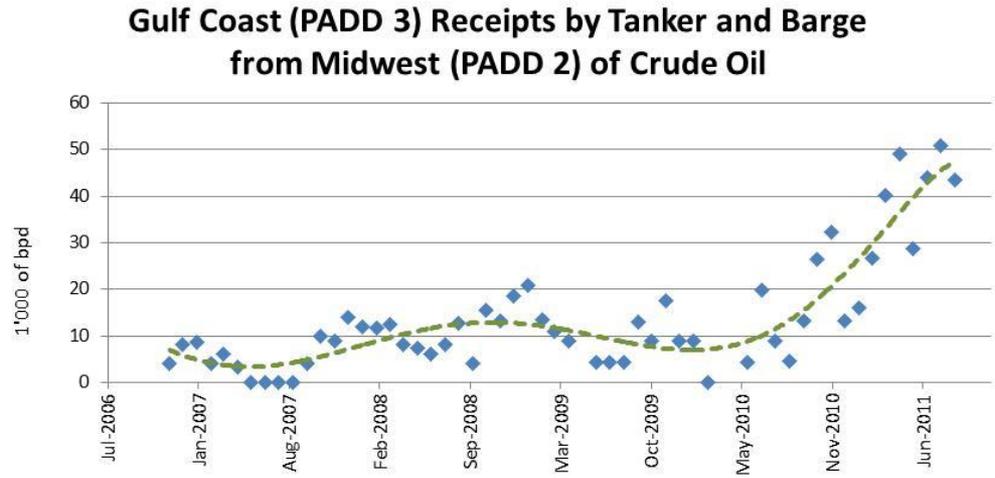


Rail: Increasing Current Capacity & Potential



Barge & Tanker: Support Pipeline/Rail

- **Pipeline to barge
PADD2 to PADD3**
 - Rising volumes
 - Wood River to USGC
 - Catoosa to USGC
 - Substantial potential given time to build barges, terminal mods



Source: U.S. Energy Information Administration

Barge & Tanker: Support Pipeline/Rail



In Summary

- **EnSys 2010 KXL Assessment concluded:**
 - **Commercial need now for KXL (or equivalent)**
 - **But KXL not essential**
 - Under normal situation and over time
 - alternative pipelines could supply capacity similar to KXL
 - including substantial further capacity to USGC
 - **Strong incentives to build pipeline capacity to BC – Asia markets**
 - **The competition is between US and Asia for WCSB crudes**
 - with Middle East crudes the main (re)balancer
 - **It is US demand reduction – not pipelines – that cuts total oil imports**
 - Low Demand scenario looked at 4 mbd less US demand by 2030



In Summary

- **EnSys 2011 KXL Update concluded:**
 - It may be possible to halt one or two major new projects
 - Keystone XL, Northern Gateway
 - But difficult to restrict pipeline mods, multiple options
 - If major pipelines were restricted, alternative transport modes can support Lower 48 and WCSB production and distribution
 - Rail increasingly presenting an alternative
 - US: potentially 1+ million bpd takeaway capacity
 - WCan: potentially 1-2 million bpd
 - Barge and tanker can play significant roles
 - Full oil sands upgrading to products in Canada also a player
 - Retaining the value in Alberta/Canada

In Summary

- **Looking forward:**
 - **Outlooks must take into account not only pipelines but also rail/barge/tanker**
 - EIA do not report oil movements by rail
 - **We are in a period of important developments**
 - Longhorn, Seaway, Wrangler/Flanagan, KXL,
 - Trans Mountain, Northern Gateway
 - **But it will take time to resolve the congestion**

Thank you !

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Extras

Newfoundland
North Atlantic.....115

Comex by Chance
Hibernia
White Rose
Terra Nova

2010 Canadian Crude Oil Production

	000 m/b/d	000 b/d
British Columbia	5	37
Alberta	326	2,052
Saskatchewan	67	421
Manitoba	5	32
Northwest Territories	2	15
Western Canada	405	2,552
Atlantic Canada	44	276
Total Canada	449	2,828

Pipeline Tolls Light Oil (\$/BBL per barrel)

Edmonton to Burnaby (Trans Mountain)	2.65
Anacortes (Trans Mountain/Pugot)	2.85
Santa (Enbridge)	3.90
Chicago (Enbridge)	3.50
Wood River (Enbridge/Mustang/Capwood)	4.65
USGC (Enbridge/Mustang/ExxonMobil)	5.90
Hardisty to Guernsey (Express/Platte)	1.50*
Wood River (Express/Platte)	1.85*
Wood River (Keystone)	4.70**
USGC (Express/Platte/MAP/ExxonMobil)	3.50
USEC to Sarnia (Portland/Montreal/Enbridge)	2.90
St. James to Wood River (Capline/Capwood)	1.00
Frappert to Wood River (Seaway/Ozark)	1.85

Pipeline Tolls -Heavy Oil (\$/BBL per barrel)

Hardisty to Chicago (Enbridge)	3.90
Cushing (Enbridge/Spearhead)	5.90
Cushing (Keystone)	5.85**
Cushing (Keystone)	6.20*
Wood River (Enbridge/Mustang/Capwood)	5.25
Wood River (Keystone)	5.30**
Wood River (Express/Platte)	2.25*

Notes: * Assumed exchange rate = 1.05 / Cdn
 ** Tolls include seasonal surcharges
 * Tolls in effect July 1, 2011
 * or was contracted toll
 ** or was contracted toll

Canadian and U.S. Crude Oil Pipelines and Refineries

- Area Refineries - Capacities in '000s barrels per day (b/d)
- PADD Petroleum Administration for Defense District (U.S.)
- Major Canadian Crude Oil Pipelines
- Approved Crude Oil Pipelines

Vancouver to:
 Japan - 4,300 miles
 Taiwan - 5,600 miles
 S. Korea - 4,800 miles
 China - 5,100 miles
 San Francisco - 800 miles
 Los Angeles - 1,100 miles

Puget Sound
 BP.....234
 ConocoPhillips.....100
 Shell.....145
 Tesoro.....120
 US Oil.....39

San Francisco
 BP.....290
 Chevron.....120
 ConocoPhillips.....120
 Shell.....165
 Tesoro.....156
 Valero.....170

Los Angeles
 BP.....365
 Chevron.....385
 ConocoPhillips.....139
 ExxonMobil.....150
 Tesoro.....87
 Valero.....125

Pitca George
 Husky.....12

Great Falls
 Montana Refining.....10

Billings
 CDS.....55
 ConocoPhillips.....58
 ExxonMobil.....60

Wyoming
 Frontier (Cheyenne).....52
 Little America (Casper).....35
 Sinclair Oil (Sinclair).....66
 Wyoming (Newcastle).....14

Salt Lake City
 Big Well.....35
 Chevron.....45
 Holly.....31
 Tesoro.....58

Denver/Commerce City
 Sunoco.....93

Oklahoma
 ConocoPhillips (Ponca City).....187
 Holly.....125
 Valero (Andromed).....90
 Wynnewood.....70

Borger/McKee
 Valero.....146
 Valero.....170

El Paso
 Western Refining.....125

Artisole
 Holly.....100

Three Rivers
 Valero.....100
 Corpus Christi
 CTECO.....165
 Flint.....300
 Valero.....315

Houston/Texas City
 BP.....475
 ConocoPhillips.....247
 Valero.....294
 Deer Park.....340
 ExxonMobil.....294
 Houston Refining.....268
 Marathon.....76
 Valero (I).....390

Port Arthur/Sassaparilla
 ExxonMobil.....365
 Motiva.....280
 Valero.....310
 Total.....174

Lake Charles/Garyville
 ConocoPhillips.....239
 CTECO.....490
 Marathon.....436
 Valero.....250

Upgraders
 Syntrude (Fort McMurray).....407
 Sunoco (Fort McMurray).....628
 Shell (Scarlett).....155
 CNR Horizon.....125
 CPT/Neuman Long Lake.....72

Edmonton
 Imperial.....187
 Sunoco.....126
 Shell.....100
 Lloydminster
 Husky.....38
 Husky Upgrader.....82

Regina
 ConocoPhillips/Upgrader.....100
 Motiva/Jaw
 Motiva/Jaw Asphalt.....15

Great Falls
 Montana Refining.....10

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Bakken Rail Takeaway Capacity Current and Future Projects

Bakken Rail Takeaway Capacity - Current and future projects		
Facility/project	Early 2011 b/d	Expected capacity by end 2012 b/d
Various Sites in Minot, Dore, Donnybrook and Stampede (est)	30,000	30,000
EOG Rail, Stanley, ND ¹	65,000	65,000
Dakota Transport Solutions, New Town, ND	20,000	40,000
Musket - Dore	15,000	30,000
Musket - Dickinson	10,000	10,000
Subtotal - Existing Projects	140,000	175,000
Hess Rail, Tioga, ND ²	in development	60,000
Rangeland COLT Hub, Epping, ND	Operational by January 1, 2012	80,000
Savage Services, Trenton, ND	Operational by 2nd Quarter of 2012	72,000
Watco & Kinder Morgan, Dore, ND	Operational by September 1, 2011	60,000
Enbridge Berthold		31,000
EDOG Logistics - Dickinson Railroad Shipping ³	Operational by September 1, 2011	200,000
BakkenLink Belfield ⁴		72,000
Subtotal - Future Projects		575,000
Total capacity	140,000	750,000
¹ Up to 90,000 b/d capacity		
² Up to 120,000 b/d capacity		
³ The facility could handle more than 500,000 b/d between stage 2 to 5 of the project		
⁴ This project hasn't been confirmed yet		
Source: North Dakota Pipeline Authority & Musket Corporation		

Barge & Tanker

- US river network opens up routing options

