Cushing Canadian Congestion & Keystone XL
A Review of Logistics Options

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COQA
Tulsa, October 27th, 2011
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](http://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

<table>
<thead>
<tr>
<th></th>
<th>Jan-09</th>
<th>Mar-09</th>
<th>May-09</th>
<th>Jul-09</th>
<th>Sep-09</th>
<th>Nov-09</th>
<th>Jan-10</th>
<th>Mar-10</th>
<th>May-10</th>
<th>Jul-10</th>
<th>Sep-10</th>
<th>Nov-10</th>
<th>Jan-11</th>
<th>Mar-11</th>
<th>May-11</th>
<th>Jul-11</th>
<th>Sep-11</th>
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<tbody>
<tr>
<td>WTI vs Brent - $/bbl</td>
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<tr>
<td>Canadian Lloydminster vs Maya - $/bbl</td>
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Today: Canadian + Cushing = Congestion

- Brent/WTI spread arguably a function of
  - Perceived time to revert toward parity
  - $x$
  - Storage costs

$\sim 4\frac{1}{2}$ years *
$\sim $0.50/bbl per month

$= \sim $25/bbl
Today: Canadian + Cushing = Congestion

- US / WC producers losing out
- Foreign producers arguably benefiting
- Midcontinent refiners benefiting

Monthly Refining Margins Coking 1/2009 - 10/2011

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
Fundamental Issue: Pipeline Capacity In Exceeds Capacity Out

- Cushing is in “I/O” imbalance

<table>
<thead>
<tr>
<th>Cushing Pipeline Capacity</th>
<th>mbd</th>
<th>mbd</th>
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<tbody>
<tr>
<td>In:</td>
<td></td>
<td></td>
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<tr>
<td>From north/east</td>
<td>0.340</td>
<td>To north/east</td>
</tr>
<tr>
<td>From west</td>
<td>0.950</td>
<td>To west</td>
</tr>
<tr>
<td>From south (Seaway)</td>
<td>0.350</td>
<td>To south</td>
</tr>
<tr>
<td>Total</td>
<td>1.640</td>
<td>0.995</td>
</tr>
</tbody>
</table>
Cushing: Storage Companies are Racing to Add Capacity

- Inventories rose about 0.4 million barrels per month since 2009
  - (Have recently dropped back)
Fundamental Issue: Pipeline Capacity In Exceeds Capacity Out

- Midwest refining projects will help relieve the pressure on WCSB heavy crudes
  - but production keeps growing

<table>
<thead>
<tr>
<th></th>
<th>Impact mbd</th>
<th>Start up</th>
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<tbody>
<tr>
<td><strong>Midwest/Midcont WCSB heavy projects:</strong></td>
<td></td>
<td></td>
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<tr>
<td>WRB Refining Wood River Illinois</td>
<td>0.130</td>
<td>2011/12</td>
</tr>
<tr>
<td>WRB Refining Borger Texas</td>
<td>0.110</td>
<td>2011/12</td>
</tr>
<tr>
<td>Marathon Detroit Michigan</td>
<td>0.080</td>
<td>2H 2012</td>
</tr>
<tr>
<td>BP Whiting Indiana</td>
<td>0.260</td>
<td>2013</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.580</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MidContinent Debottlenecking</strong></td>
<td>0.100</td>
<td>2011/12</td>
</tr>
</tbody>
</table>
## Fundamental Issue: Pipeline Capacity In Exceeds Capacity Out

- **Major pipeline projects are needed**

<table>
<thead>
<tr>
<th>Projects to US Gulf Coast</th>
<th>Capacity mbd</th>
<th>Start up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magellan Longhorn Reversal</td>
<td>0.135/0.225</td>
<td>2013</td>
</tr>
<tr>
<td>Enterprise / ETP “Double E”</td>
<td>0.400</td>
<td>4Q 2012</td>
</tr>
<tr>
<td>Enbridge Monarch</td>
<td>0.150&gt;0.300</td>
<td>4Q 2012</td>
</tr>
<tr>
<td>Flanagan / Wrangler Pipeline (Enbridge, Enterprise Product Partners)</td>
<td>Flanagan 0.300 Wrangler 0.800</td>
<td>2Q 2013</td>
</tr>
<tr>
<td>Transcanada Keystone XL</td>
<td>0.700</td>
<td>2013??</td>
</tr>
<tr>
<td>Transcanada Keystone XL expansion</td>
<td>0.130</td>
<td>2015?</td>
</tr>
<tr>
<td><strong>Total to GC</strong></td>
<td><strong>up to 1.8</strong></td>
<td></td>
</tr>
</tbody>
</table>
**Fundamental Issue:**

**Pipeline Capacity In Exceeds Capacity Out**

- **Major pipeline projects are needed**

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

(1) Open seasons planned late 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 (2013?)**
  - 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 is 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 Final Environmental Impact Statement released
  - In comment & “national interest determination” period
  - EPA comments
  - Nebraska routing
Result is Pipeline Focus & Uncertainty

Source: CAPP Report June 2011

Refining growth

Competition between USA and Asia

Refining capacity
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

**Tier 1:** Major new pipelines
- Decreasing scale / capacity
- Increasing $/bbl rate
- Decreasing capital cost

**Tier 2:** Existing pipeline mods / ROW
- Decreasing scale of commitment
- Increasing ease of permitting
- Decreasing time to implement

**Tier 3:** Rail, barge, tanker

Increasing number of options
Rail: Different Economics vs Pipeline

• $/bbl rate usually higher but
  – Unit trains bringing better economics
  – Far lower capital cost / scaleable
  – 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 <= 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

![Graphs showing rail border crossings and trains/day/active crossing](source: U.S. Department of Transportation)
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

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

[Map showing rail routes from Canada and Bakken to various destinations in the United States and Canada]
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
A range of options exists
In Summary

- **EnSys 2010 KXL Assessment showed:**
  - Commercial need now for KXL (or equivalent)
  - 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 balancer
  - It is US demand reduction – not pipelines – that cut total oil imports
    - Low Demand scenario looked at 4 mbd less US demand by 2030
In Summary

• EnSys 2011 KXL Update showed:
  – It may be possible to halt one or two major new projects
    • Keystone XL, Northern Gateway
  – But difficult to restrict pipeline mods
  – 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
    • WC: potentially 1-2 million bpd
  – Barge and tanker can also play significant roles
  – Full oil sands upgrading to products in Canada also a player
In Summary

• Looking forward:
  – No assessment of outlook is complete unless it takes into account not only pipelines but also rail/barge/tanker
    • EIA do not report oil movements by rail
  – Next few months will see important developments
    • KXL, Wrangler/Flanagan, Trans Mountain, (Northern Gateway)
  – But it will take time to resolve the congestion
Thank you!

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Extras
### Bakken Rail Takeaway Capacity - Current and Future Projects

<table>
<thead>
<tr>
<th>Facility/project</th>
<th>Early 2011 b/d</th>
<th>Expected capacity by end 2012 b/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various Sites in Minot, Dore, Donnybrook and Stampede (est)</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>EOG Rail, Stanley, ND</td>
<td>65,000</td>
<td>65,000</td>
</tr>
<tr>
<td>Dakota Transport Solutions, New Town, ND</td>
<td>20,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Musket - Dore</td>
<td>15,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Musket - Dickinson</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Subtotal - Existing Projects</strong></td>
<td><strong>140,000</strong></td>
<td><strong>175,000</strong></td>
</tr>
<tr>
<td>Hess Rail, Tioga, ND</td>
<td>in development</td>
<td>60,000</td>
</tr>
<tr>
<td>Rangeland COLT Hub, Epping, ND</td>
<td>Operational by January 1, 2012</td>
<td>80,000</td>
</tr>
<tr>
<td>Savage Services, Trenton, ND</td>
<td>Operational by 2nd Quarter of 2012</td>
<td>72,000</td>
</tr>
<tr>
<td>Watco &amp; Kinder Morgan, Dore, ND</td>
<td>Operational by September 1, 2011</td>
<td>60,000</td>
</tr>
<tr>
<td>Enbridge Berthold</td>
<td></td>
<td>31,000</td>
</tr>
<tr>
<td>EDOG Logistics - Dickinson Railroad Shipping</td>
<td>Operational by September 1, 2011</td>
<td>200,000</td>
</tr>
<tr>
<td>BakkenLink Belfield</td>
<td></td>
<td>72,000</td>
</tr>
<tr>
<td><strong>Subtotal - Future Projects</strong></td>
<td><strong>575,000</strong></td>
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<tr>
<td><strong>Total capacity</strong></td>
<td><strong>140,000</strong></td>
<td><strong>750,000</strong></td>
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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

Source: Kirby Corporation