The North American Petroleum Renaissance and Keystone XL – Challenges and Opportunities in Meeting the Infrastructure Needs

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Energy Policy Research Foundation, Inc. (EPRINC)
Platts Pipeline Development and Expansion Conference
September 20th, 2012
Who is EPRINC?

EPRINC stands for Energy Policy Research Foundation, Inc. Non-profit research group that does economic and policy analysis on the petroleum industry.

Founded in 1944 in New York. Established as a group to explain markets and fundamentals.

Previously the Petroleum Industry Research Foundation, Inc (PIRINC) until we moved to Washington in 2007.

Grew largely into a downstream organization, but have since moved extensively into upstream and midstream.

Extensive work on ethanol, refining, U.S. shale plays, Keystone XL.

www.eprinc.org -- check out our research, its free.
Main Discussion Points

1) Trends in production throughout the Northern Tier in the next 5-10 years
2) Likely markets for U.S. light and Canadian heavy crude oils
3) Keystone XL and its relationship to other Canadian and U.S. Midcontinent projects
4) Prospect for movement of new crude supplies to U.S. East and West coasts
5) Regulatory and markets constraints on movement of North American crude production
6) Timely permitting of downstream value added processing facilities
7) Role of exports of refined petroleum products
NPC Findings

Note: The oil supply bars for 2035 represent the range of potential supply from each of the individual supply sources and types considered in this study. The specific factors that may constrain or enable development and production can be different for each supply type, but include such factors as whether access is enabled, infrastructure is developed, appropriate technology research and development is sustained, an appropriate regulatory framework is in place, and environmental performance is maintained.

Source: Historical data from Energy Information Administration and National Energy Board of Canada.
Remember to be humble...Projected Imports of LNG vs. Actual

Source: EIA data and forecasts
EPRINC’s Forecast for Major U.S. Shale Plays

Adding 4 mbd by 2020 with selected plays alone—upside exists in periphery plays and enhanced recovery

Source: HPDI data with EPRINC forecast estimates
The Forecast Numbers

**Bentek**
- Between 2011-2016 3/1 mbd increase (or 36%) in both Canadian and US oil production
- 900,000 b/d increase in exports from Canada to US
- US oil imports (exclude Canada) drop 2.8 mbd or 41% to 3.9 mbd average by 2016

**Raymond James**
- “U.S. oil production (excluding NGLs) will grow from 5.6 MMBpd in 2010 to a whopping 9.1 MMBpd in 2015. Including natural gas liquids, total U.S. petroleum liquid production grows 60% from 7.7 MMBpd in 2010 to 12.2 MMBpd in 2015.”

**Citi (from 2011 to 2020)**
- US liquids grow from 9 mbd to 15.5 mbd
- Canada liquids grow from 3 mbd to 7 mbd
Total Canadian Oil Production (NEB Reference Case)


Additional 1 mbd in three years = tightness

Maybe some upside in tight oil
Canadian Consumption to Remain Flat...

....Every incremental barrel must be exported

Source: EIA
Canadian Consumption to Remain Flat...

Source: EIA
U.S. Production Increases

Source: EIA, and EPRINC estimates using HPDI data

North Dakota: 660,000 b/d
Niobrara: 60,000 b/d
Anadarko Basin: 160,000 b/d
Permian Basin: 1,175,000 b/d
Eagle Ford: 510,000 b/d
Incremental North American Liquids Production

2010-2017

- Canadian Oil Sands + 1-1.5 mm b/d
- U.S. Onshore Crude Oil + 2.5-3 mm b/d
- U.S. NGLs + 1 mm b/d

5 mm b/d of new onshore production in seven years. U.S. offshore (arctic, gulf), Canadian shale, Mexico provide additional upside potential. Brazil will likely contribute an addition 1-1.5 mm b/d.
Resulting Decline in US Net Imports*

*Holds all US crude oil and biofuel production constant except for the plays listed in the previous slides. Assumes 1 mm bd of Canadian production growth dispersed evenly over 5 years, and that all incremental Canadian production enters the US. Also assumes US demand remains unchanged from current levels.
NGL Production Outlook to 2020

Source: EIA Data, EPRINC forecast. Assumes ethane continues to incrementally increase its share of the NGL pool.
Low Cost Nat Gas Lowers Production Costs

U.S. Refiners’ Effective Cost of Production

Effective Production Cost takes into account a refinery’s ability to use heavy crude feedstocks (complexity), product slate (yields) and operating costs (OPEX).

Source: OGI Data for 2009, EPRINC Calculations
U.S. Rig Count

Source: HPDI September 4th, 2012
U.S. Shale/Tight Oil and Conventional Plays

Source: EPRINC, not to scale
U.S. and North Dakota and Texas Rig Count

Source: Baker Hughes Sept 7, 2012. All but 51 rigs nationwide are onshore.
Williston Basin Production

North Dakota accounts 10% of US Production

Almost all new production is from the Bakken/Three Forks

Source: NDIC
Eagle Ford Production

Source: HPDI  September 4th, 2012
What’s happening to prices?
Brent, WTI, and Bakken Markets

Source: AFPM Map; Sept 6, 2012 Bloomberg Brent and WTI Prices; Flint Hills and estimates, Canadian assumptions
Bakken Prices at Clearbrook

Bakken Clearbrook Differentials to WTI

Rate Chart for USCSUHC1

Interactive USCSUHC1 Chart

Rate Profile Information for USCSUHC1

This Bakken crude oil price spread vs the nearby month spot WTI crude oil price represents delivery at Clearbrook, MN. Typical trades are in lots of about 1,000 to 2,000 barrels a day on the Enbridge pipeline, which moves this light sweet crude oil from North Dakota to its terminus in Clearbrook, MN. Bakken crude oil’s specific gravity is 0.8299, API gravity is about 39 and sulfur content about 0.18%.

Source: Bloomberg, June 14, 2012
North Dakota Discounts

Canadian discounts even steeper

Source: Flint Hills, EIA, and estimates
Why?
Markets for Canadian Crude

• The current markets for Canadian crude are the Rockies (PADD 4) and the Midwest (PADD 2)

• The potential exists in Asia and the Gulf Coast...substantially knocking out heavy Mexican and Venezuelan imports in the US Gulf Coast

• But due to regulatory and environmental hurdles, PADD III access has been postponed and thereby tightness has been created – and too much light sweet in the market, no need for SCO in the U.S.
Canadian Imports and Potential Markets

Source: EPRINC rendition from Enbridge. Enbridge used EIA and NEB Data and Enbridge Estimates (with some averages)

Crude Disposition by Region 2010 (MB/D)
Canadian Crude Flows

Source: Canadian Pipeline Transportation System, NEB, July 2009
Choke Points

Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software
Where heavy (blended bitumen) needs to go...

Source: AFPM map, EIA data for graph
Canadian Pipeline Export Options

- Kinder Morgan’s Transmountain line off BC coast - currently 300,000 b/d capacity - recent announcements to expand up to 800,000 b/d (early 2017)
- Platte line to Wood River 280,000 b/d-full
- All FULL -- need for XL and Gateway creates opportunity for rail
- Enbridge mainline system currently transporting over 1.5 mbd with potential capacity around 2.5 mbd
- TransCanada’s Keystone 581,000 b/d-full

Source: Canadian Energy Pipeline Association
U.S. Cracking Margins

Source: Data from Platts
U.S. Exports of Finished Petroleum Products

Source: EIA
East Coast taking little Canadian Crude

- Mainly SCO, but some blended bitumen

Source: EIA
PADD II imports are almost all Canadian

Source: EIA
PADD III...has the cokers and is getting none of the crude

Source: EIA
ALL Imports into the Rockies are from CANADA

Source: EIA
PADD V takes small amounts of Canadian, could take more

Source: EIA
PADD II will be importing more HEAVY...

....pushing out light

<table>
<thead>
<tr>
<th>Refinery Feedstock Change (kbpd)</th>
<th>Year</th>
<th>Light</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConocoPhillips Wood River</td>
<td>2011</td>
<td>-130</td>
<td>+160</td>
</tr>
<tr>
<td>BP Whiting</td>
<td>2013</td>
<td>-260</td>
<td>+260</td>
</tr>
<tr>
<td>Marathon Detroit</td>
<td>2013</td>
<td>-65</td>
<td>+80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>-455</td>
<td>+500</td>
</tr>
</tbody>
</table>

Source: Enbridge presentation April 2012, Denver, Platts Rockies Oil and Gas Conference
Refinery Utilization by PADD

Low Utilization in PADD I

PADD I refiners face high feedstock and regulatory costs, declining demand—leading to capacity losses.

Source: EIA Data
Refinery Acquisition Cost of Crude

PADD 1 has the highest RAC in the U.S. – and the least heavy crude processing capability

Source: EIA Data
# U.S. Crude Production Directly Impacting PADD I

## Table 1. U.S. East Coast Refineries Operating Capacity

<table>
<thead>
<tr>
<th>Owner</th>
<th>City</th>
<th>State</th>
<th>Operating Crude Unit Capacity (bbl/calendar day)</th>
<th>Percent of Region</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConocoPhillips</td>
<td>Linden</td>
<td>NJ</td>
<td>238,000</td>
<td>17%</td>
<td>Operating</td>
</tr>
<tr>
<td>PBF Energy Co. LLC</td>
<td>Delaware City</td>
<td>DE</td>
<td>182,200</td>
<td>13%</td>
<td>Operating</td>
</tr>
<tr>
<td>PBF Energy Co. LLC</td>
<td>Paulsboro</td>
<td>NJ</td>
<td>160,000</td>
<td>12%</td>
<td>Operating</td>
</tr>
<tr>
<td>United Refining Co.</td>
<td>Warren</td>
<td>PA</td>
<td>65,000</td>
<td>5%</td>
<td>Operating</td>
</tr>
<tr>
<td>American Refining</td>
<td>Bradford</td>
<td>PA</td>
<td>10,000</td>
<td>1%</td>
<td>Operating</td>
</tr>
<tr>
<td>Ergon-West Virginia</td>
<td>Newell/Congo</td>
<td>WV</td>
<td>20,000</td>
<td>1%</td>
<td>Operating</td>
</tr>
<tr>
<td>Hess Corp.</td>
<td>Port Reading</td>
<td>NJ</td>
<td>0*</td>
<td>0%</td>
<td>Operating</td>
</tr>
<tr>
<td>Sunoco Inc.</td>
<td>Philadelphia</td>
<td>PA</td>
<td>335,000</td>
<td>24%</td>
<td>Operating, For Sale</td>
</tr>
<tr>
<td>Sunoco Inc.</td>
<td>Marcus Hook</td>
<td>PA</td>
<td>178,000</td>
<td>13%</td>
<td>Idled 12/2011, For Sale</td>
</tr>
<tr>
<td>ConocoPhillips</td>
<td>Trainer</td>
<td>PA</td>
<td>185,000</td>
<td>13%</td>
<td>Idled 9/2011, For Sale</td>
</tr>
</tbody>
</table>

**Total Operating and Idled: 1,373,200 (100%)**

### Recently Shut Refineries

- **SOLD: Plains All American**
  - Western Refining
    - Yorktown, VA: 66,300
    - Shut 9/2010
  - Sunoco Inc.
    - Eagle Pt/Westville, NJ: 145,000
    - Shut 2/2010

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*Hess Port Reading has a production capacity of 70,000 bbl/calendar day but no crude unit capacity.*

**Notes:** Yellow shading indicates operating refineries for sale and at risk of shutdown. Orange shading indicates idled refineries for sale and at risk of shutdown. Red shading indicates shut refineries. Total refinery capacity excludes two refineries that primarily produce asphalt, as well as the Yorktown VA and Eagle Point refineries that were shut down in 2010.

**Source:** U.S. Energy Information Administration.
U.S. Exporting about 1 mbd of Product

Source: EIA
U.S. Imports by API Gravity

Source: EIA
Infrastructure Options and Outcomes
Rail is a Contender

Major rail companies in the U.S. and Canada are moving hundreds of thousands of barrels of crude each day. The Bakken is clearly the leader in this space, but more Canadian crude is beginning to move by rail as crude chases better prices at premium markets.

News Release

BNSF Expands Bakken Oil Transport Capacity to One Million Barrels per day

FORT WORTH, Texas, September 4, 2012:

CRUDE BY RAIL
A proven model with growing demand

• Key benefits
  – Speed
  – Capacity
  – Flexibility
  – Optionality
  – Scalability

Source: Images directly from BNSF, CP, and CN websites
Crude Pipeline Infrastructure

- Severely limited due to lack of Keystone XL and lack of historical build out to the coasts

Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software
Rail Infrastructure

Can get to the markets
pipeline can’t

Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software
North American Rail Map

- New markets
- Diversification
- Neat Barrels
- Nimble - Quickly adjustable
- Optionality for Canadian and U.S. crude

Source: Watco Companies LLC, Presentation Bakken Product Markets and Take-Away Denver Jan 31-Feb 1 2012
Average Weekly U.S. and Canadian Railcar Loads of Crude Oil and Petroleum Products

Source: Association of American Railroads. Weekly Railroad Traffic
Note: Data are weekly average originations for each month, are not seasonally adjusted; one carload holds 30,000 gallons (or 714.3 barrels).
Williston Basin Crude Oil Transport

October 2011 Estimates
- 67% Pipeline Export
- 18% Tesoro Refinery
- 10% Truck Exports
- 5% Rail

January 2012 Estimates
- 58% Pipeline Export
- 25% Tesoro Refinery
- 10% Truck Exports
- 7% Rail

June 2012 Estimates (Current)
- 47% Pipeline Export
- 6% Tesoro Refinery
- 3% Truck Exports
- 44% Estimated Rail

Source: North Dakota Pipeline Authority
Current Williston Basin Take-Away

Production: 727,000 b/d (660k ND; 62k East MT; 5k SD)

- Pipeline Capacity 380,000 b/d: about 350,000 running...(down from 362,000 in June 2012)

- Tesoro Mandan Refinery Capacity 58,000 b/d: 45,000 b/d running (down from 59,000 in June 2012 due to maintenance)

- Truck to Canada (then put in pipeline): 7,000 b/d running (down from 20,000 in June 2012)

- Rail: 325,000 b/d running (up from 180,000 b/d in May)
Williston Basin Pipeline and Rail Take-Away Capacity

Source: North Dakota Pipeline Authority, Included Planned Projects
Value of Rail vs. Pipeline

- Volume flexibility (ups and downs in production)
- Access new and high value markets (St.James LLS prices)
- Neat Barrels
- Competitive for every incremental barrel (a lot of new barrels coming on)
- Long-term stability, reliability
- Low cost transport to traditional and liquid markets
- Competes with rail and local refineries for incremental barrels

Source: Hess, Presentation Bakken Product Markets and Take-Away Denver Jan 31-Feb 1 2012
Major Regulatory Issues and Hurdles

- Oil prices
- Environmental Concerns
- Excessive Regulation
- Regs on Federal Land-Fracking
- Infrastructure Delays
- Lack of prudent policy making, not fully grasping the positive benefits and understanding of the bigger picture

Source: North Dakota Industrial Commission presentation May 2012 Lynn Helms

- Infrastructure
- Manpower
- Housing
- Gas gathering and processing
- Oil transportation
- Federal regulation
- Global Environmental Group interest
Conclusions

• US and Canadian production surging
• Pipelines are being built, but right now their exists tightness—need Gateway, XL, and Costal options for US and Canadian crude
• Rail is a serious option for US producers distanced from refining centers
• Rail could be an alternative shipping method for oil sands producers as they look to diversify their options and secure stable prices—markets exist where pipeline doesn’t (especially with XL delay and Gateway uncertainty)
• Blended bitumen needs to get to the Gulf and potentially PADD V
• Bakken light sweet needs to get to East Coast PADD I....only so much light sweet can be sent to Cushing and down into Gulf
What does all this mean?

- This is a petroleum renaissance. The U.S. is the largest producer of gas in the world and quickly becoming one of the lowest cost energy producers in the world

- Potential to substantially decrease crude imports into U.S., with significant benefits to our import bill and billions in economic benefits to the U.S. economy

- Potential to become a natural gas exporter (already significant petroleum products exporter)

- Need for prudent policy making so the infrastructure can keep up with the production and the full value can be captured = crude and Nat gas need to get to refineries so that they can be processed

- Major new pipeline infrastructure will deliver sustained and large scale benefits-Keystone decision has created uncertainty on whether those benefits will be realized.

- U.S. is now poised for major economic renaissance from the both oil sands and unconventional natural gas and liquids. Net present value of $1 to $2 trillion if appropriate policies put into place.

- Paradigm shift and large scale economic benefits are possible, but not without new approach to government regulations (and permitting) of both midstream and downstream facilities --- refinery expansions and modifications, natural gas processing, petrochemicals, LNG.

- U.S. now poised to be a major export platform for value added oil and gas processing. Major expansion of domestic manufacturing -- transformation of national economy now in the cards.

- U.S. is fast becoming the low cost petrochemical export platform. Wild card risk remains government policy.