

The Game is Changing

Infrastructure and the North American Petroleum Renaissance



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Energy Policy Research Foundation, Inc.
(EPRINC)

Williston Basin Petroleum Conference
May 1st, 2013



Who is EPRINC?

Energy Policy Research Foundation, Inc. (EPRINC)

Non-profit research group that does economic and policy analysis on the petroleum industry (reports, presentations, embassy series)

Est. 1944 in New York as PIRINC (Petroleum Industry Research Foundation, Inc.). Helped to explain markets and fundamentals of the heating oil industry

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

Name change in 2007 with move to Washington, DC

Extensive work on ethanol, refining, U.S. shale plays, Keystone XL, natural gas flaring, etc...

www.eprinc.org

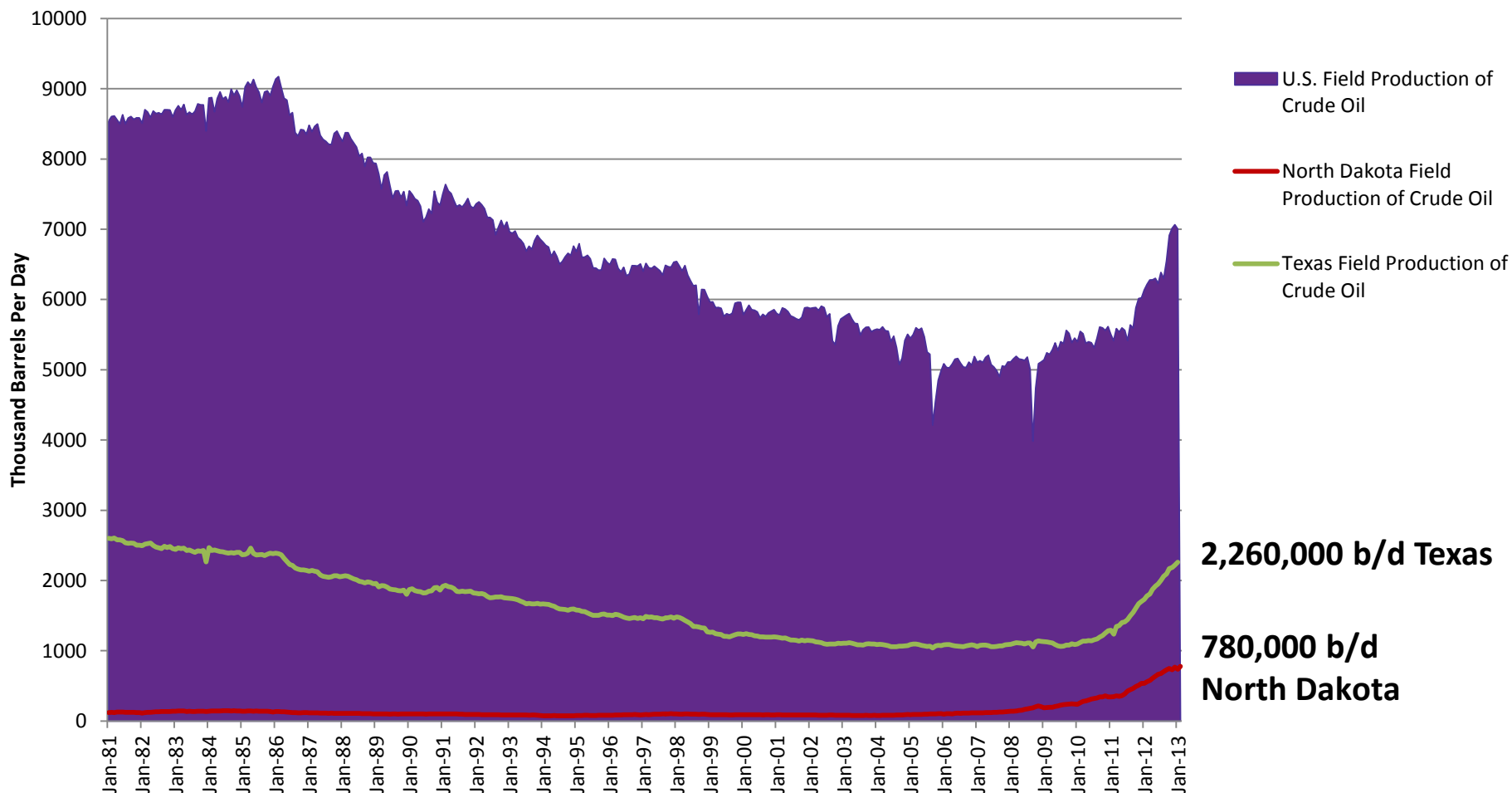
Our reports and presentations are free and available to the public

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Main Discussion Points

- 1) Trends in production
- 2) Likely markets for U.S. light and Canadian heavy crude oil
- 3) U.S. crude imports
- 4) Keystone XL and its relationship to other Canadian and U.S. Midcontinent projects
- 5) Pricing and Logistical Constraints
- 6) Prospect for movement of new crude supplies to U.S. East and West coasts

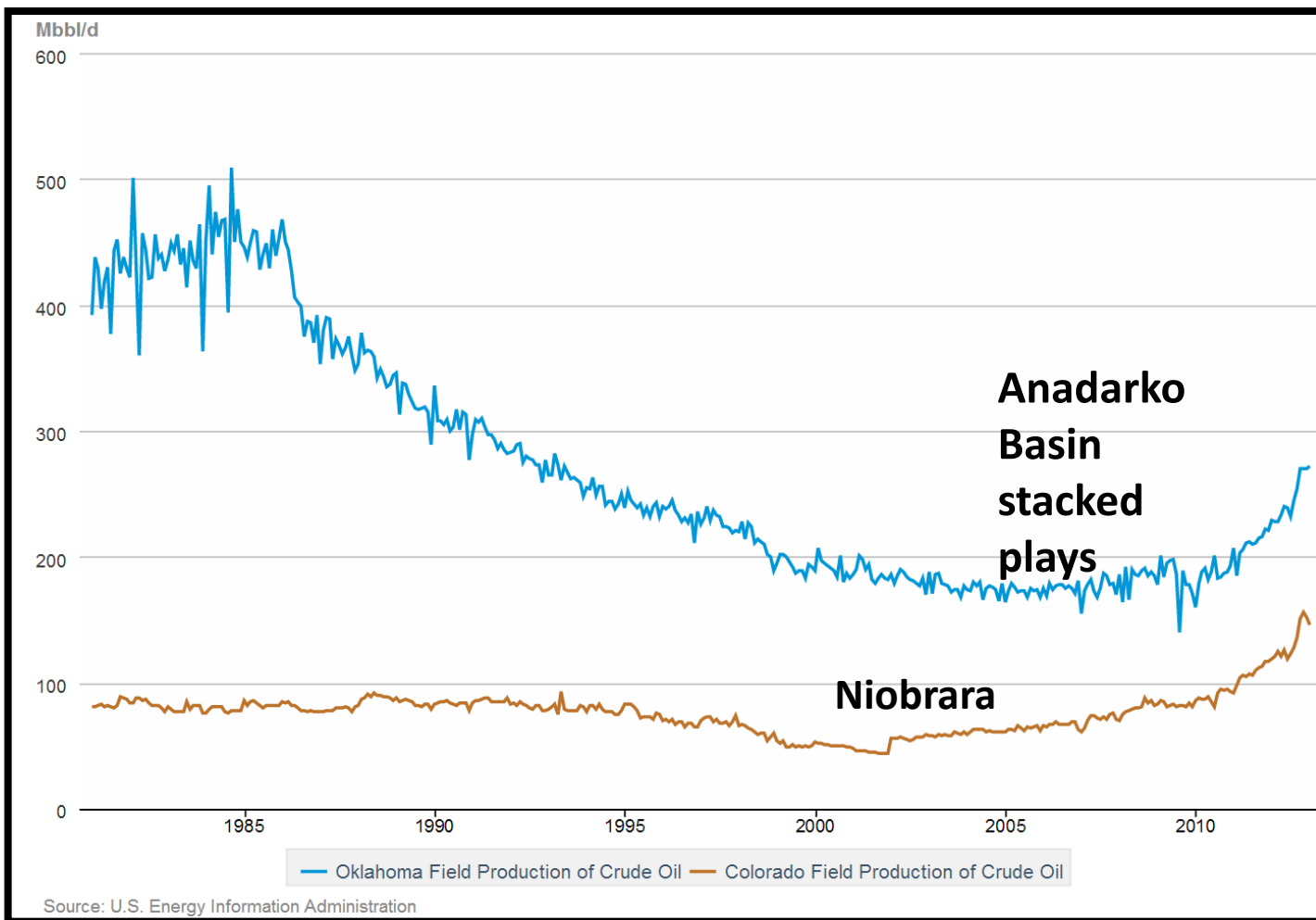
U.S. Oil Production - Over 7 mbd



Source: EIA (mbd million barrels per day)

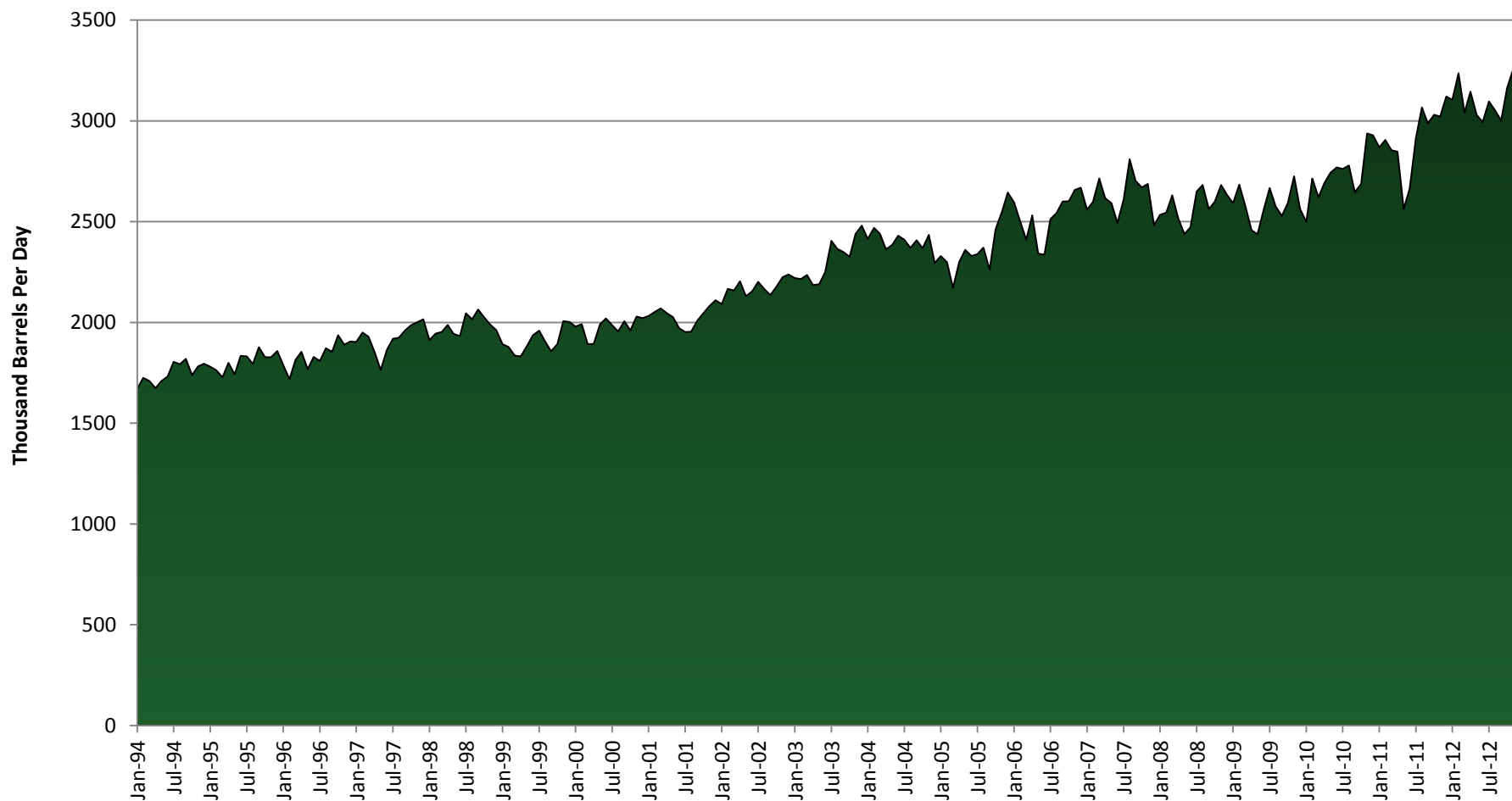
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Other U.S. Growth Stories



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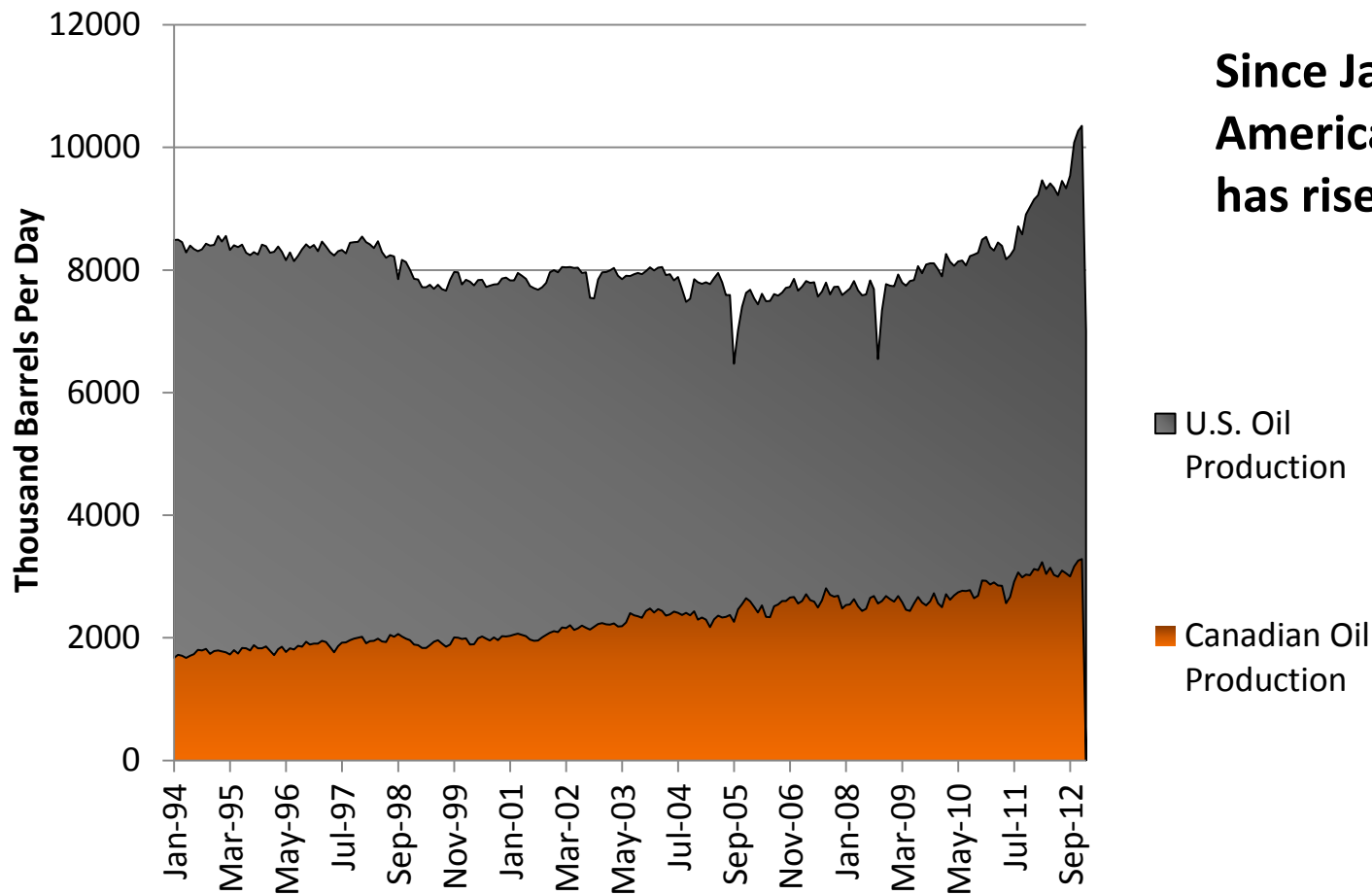
Canadian Oil Production- 3.3 mbd



Source: EIA (mbd million barrels per day)

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Nearly 3 mbd growth in North America in 4 years

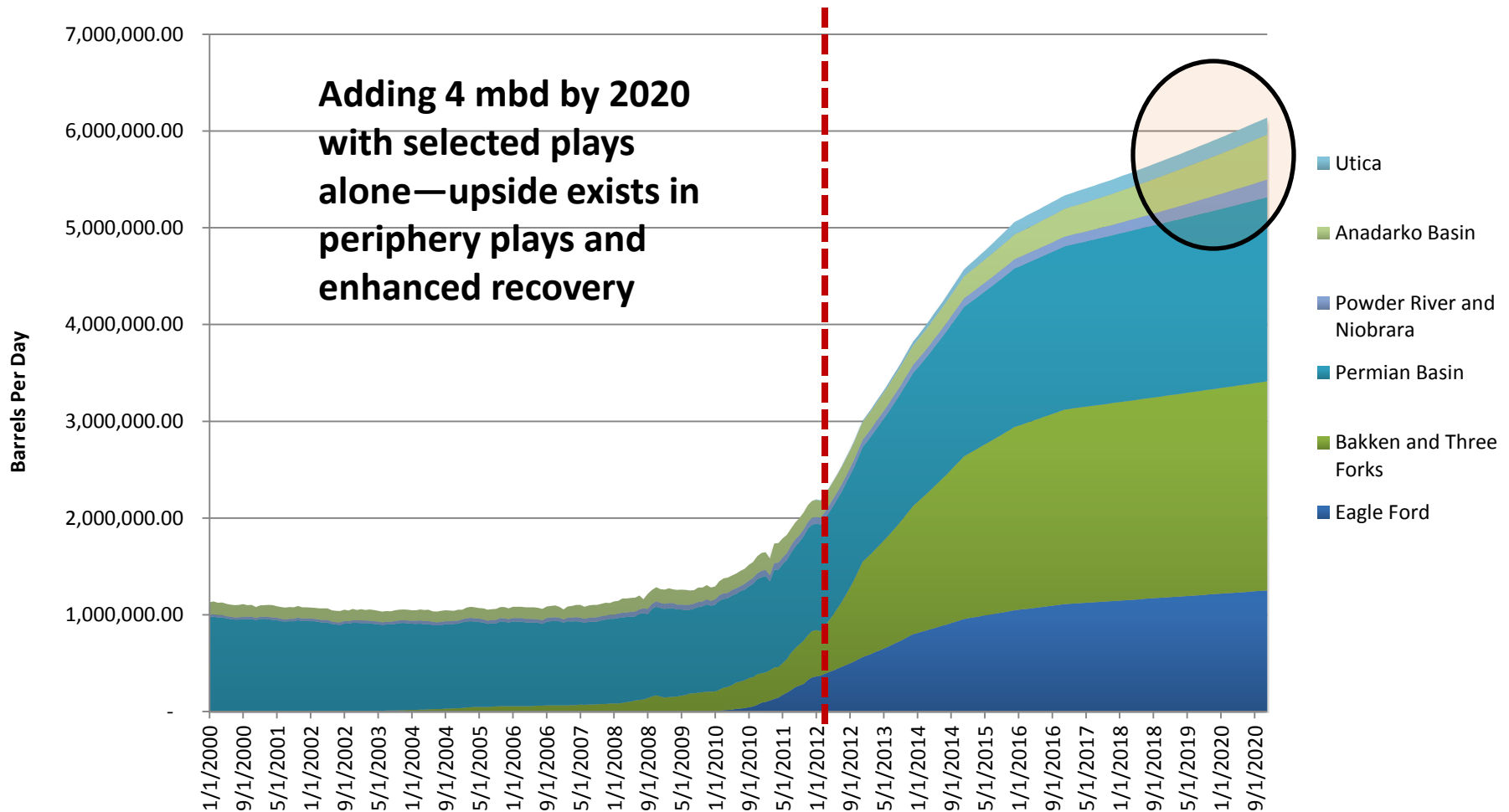


Since January 2008 North American oil production has risen by 2.7 mbd

Source: EIA (mbd million barrels per day)

Renaissance in the Making

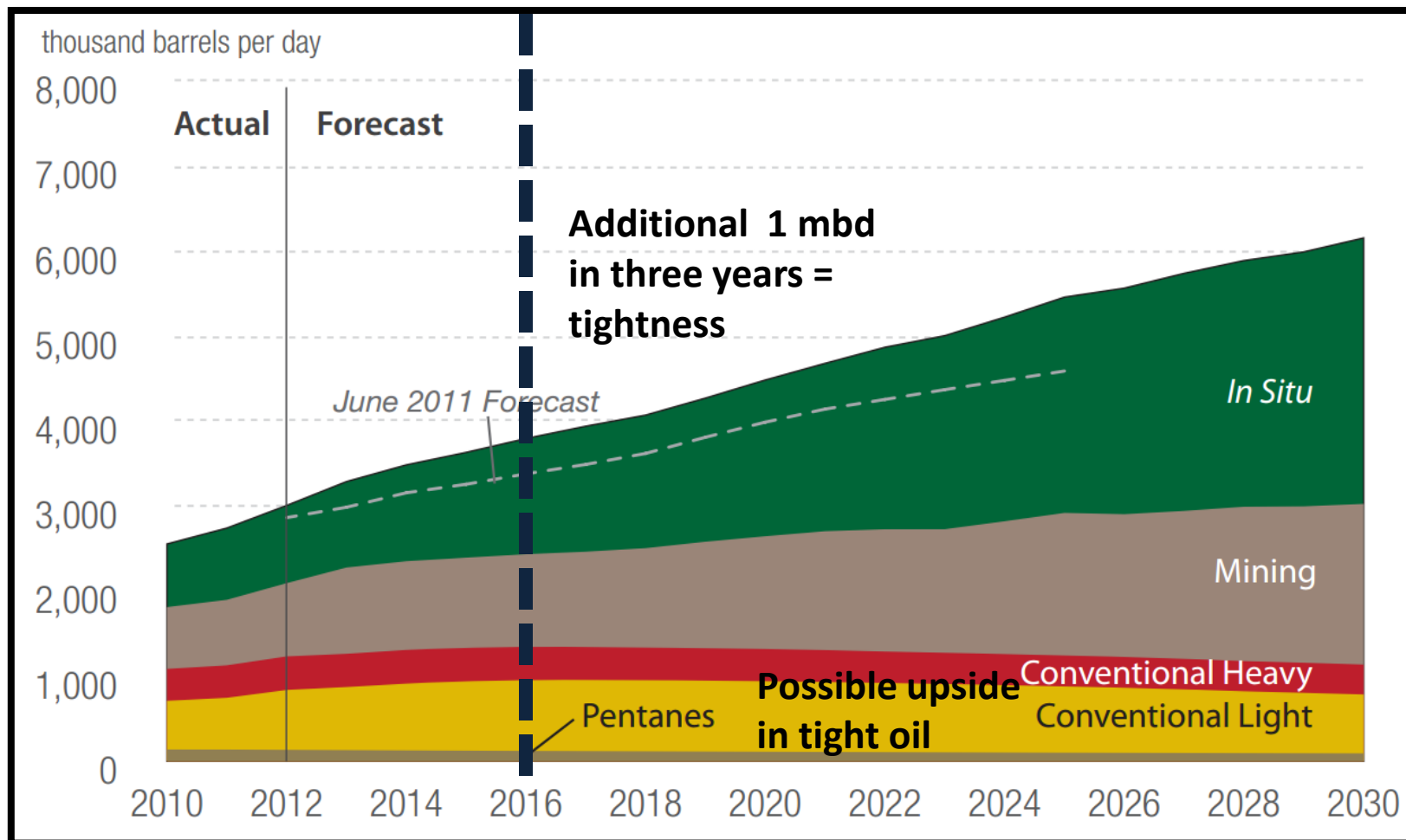
EPRINC's Forecast for Major U.S. Shale Plays



Source: HPDI data with EPRINC forecast estimates

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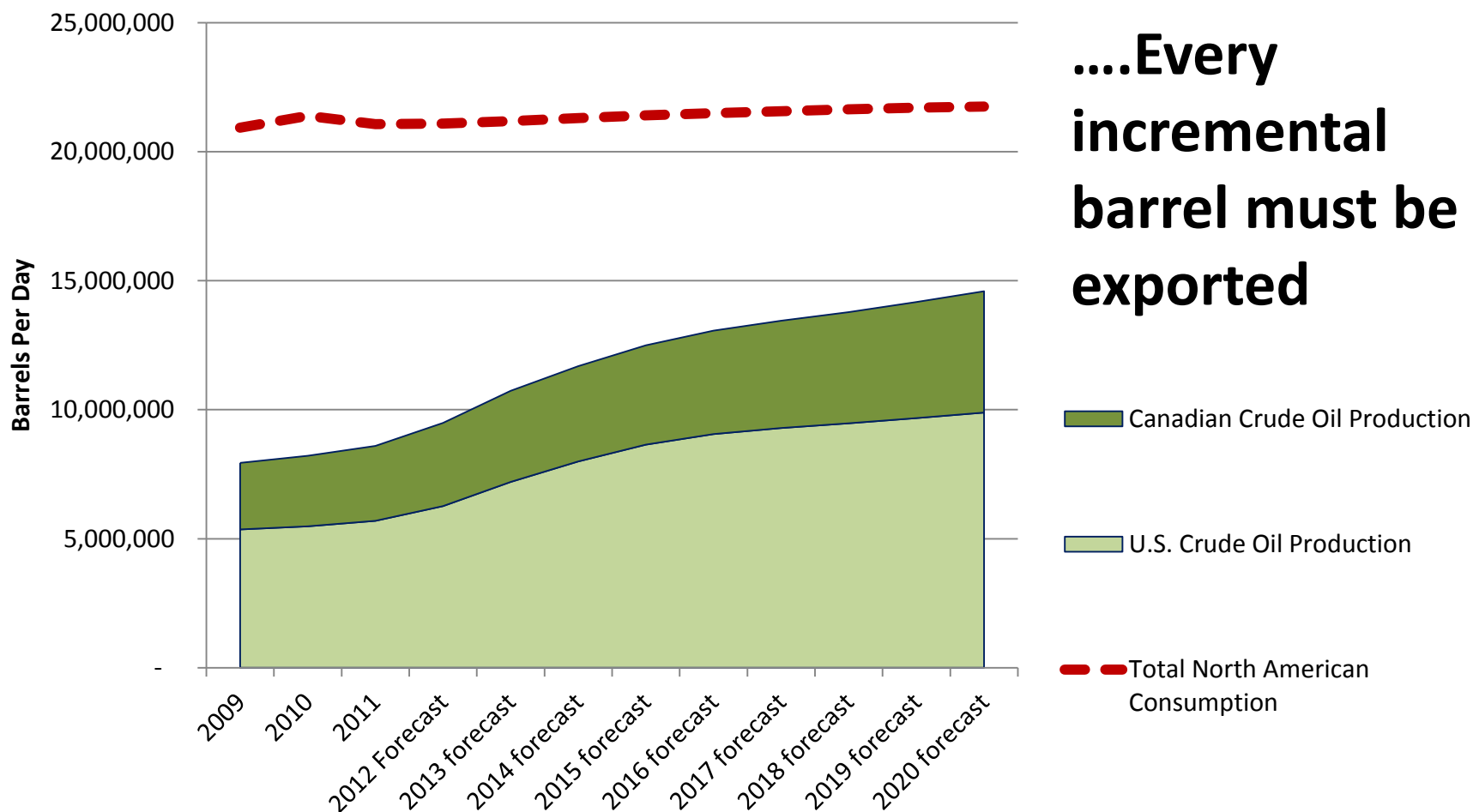
Canadian Production Forecast



Source: CAPP

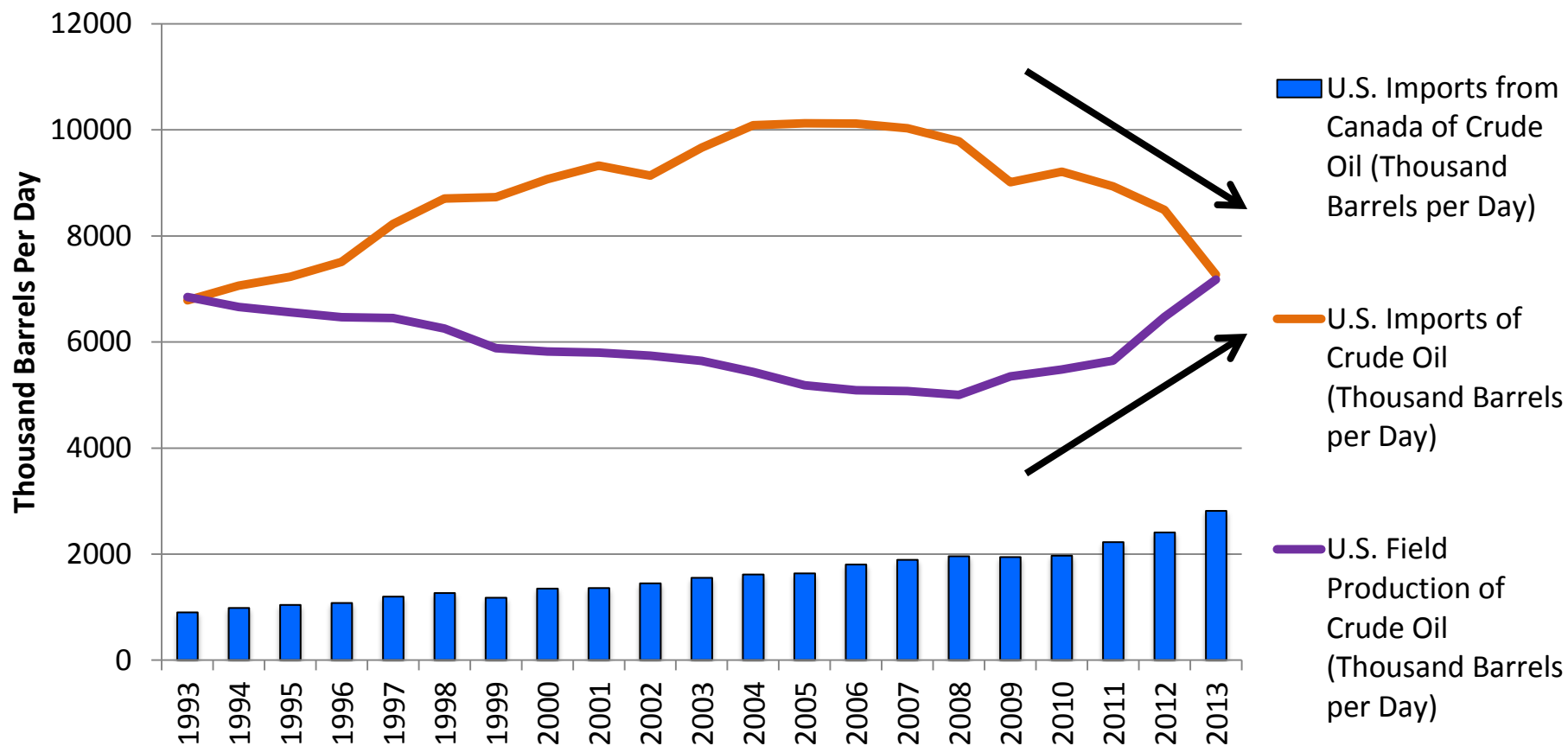
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Canadian Consumption to Remain Flat...



Source: EPRINC forecast using HPDI data, EIA, BMI, CAPP

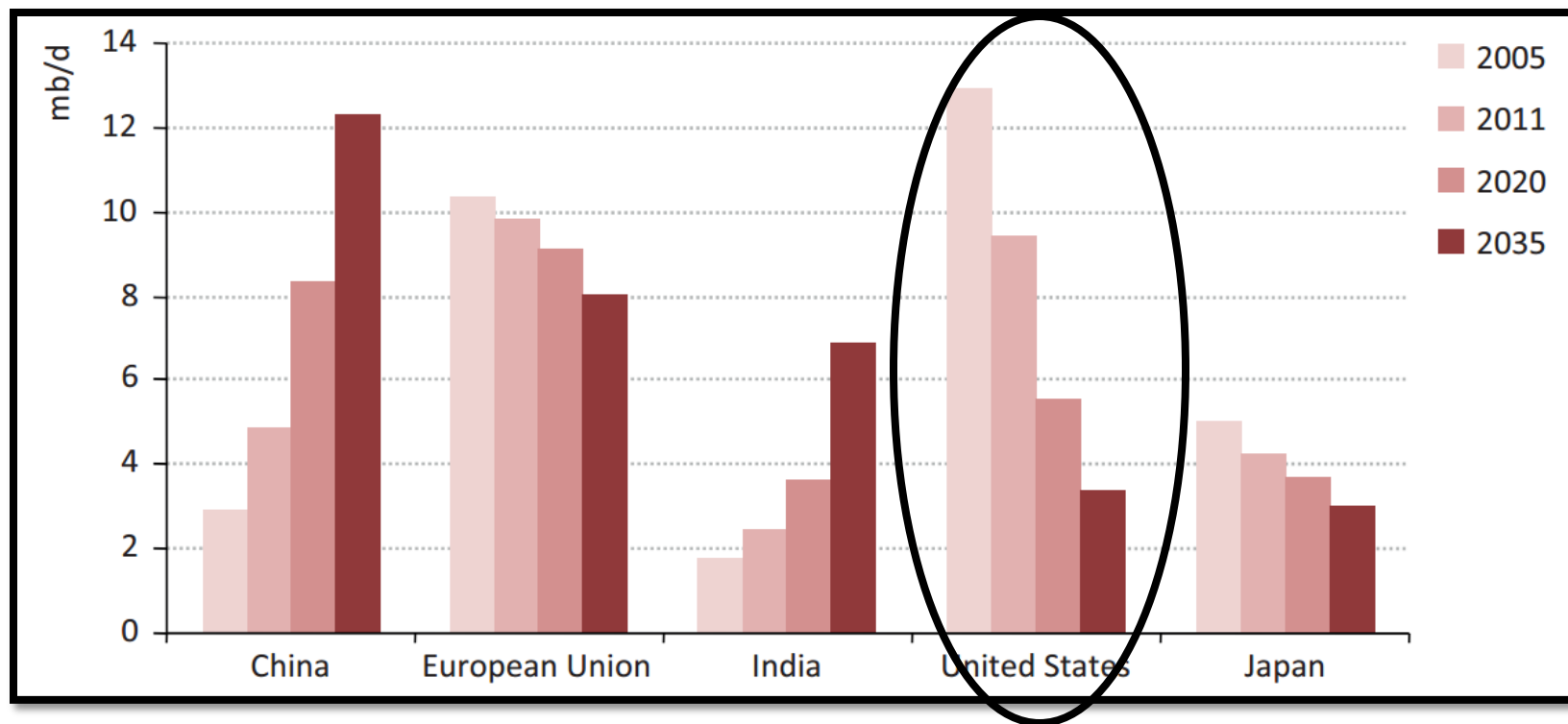
U.S. Total Imports, U.S. Production, U.S. Canadian Imports



Source: EIA

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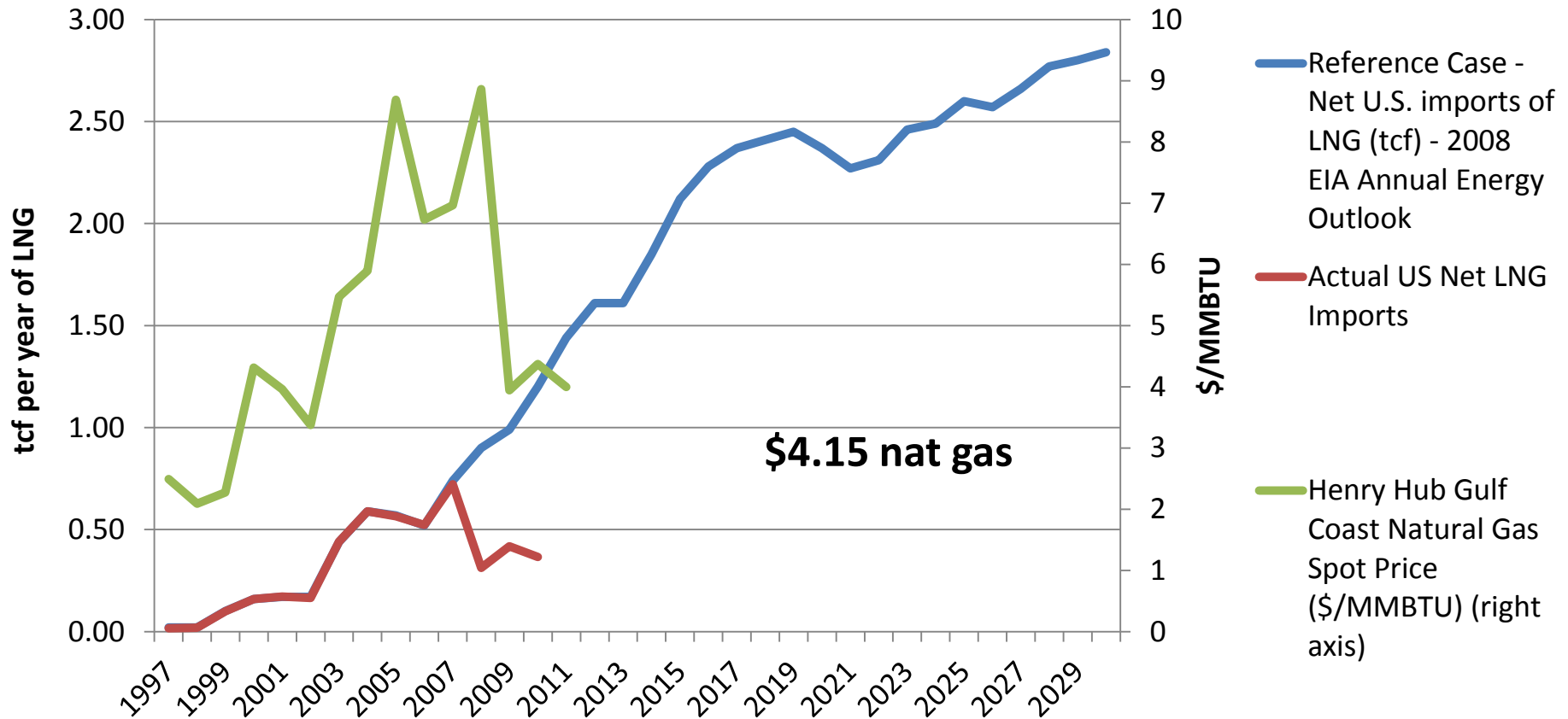
U.S. Reducing Imports...Global Impacts



Fuel efficiency, plateauing demand, and rising production offer the potential to drastically reduce oil imports over the coming years.

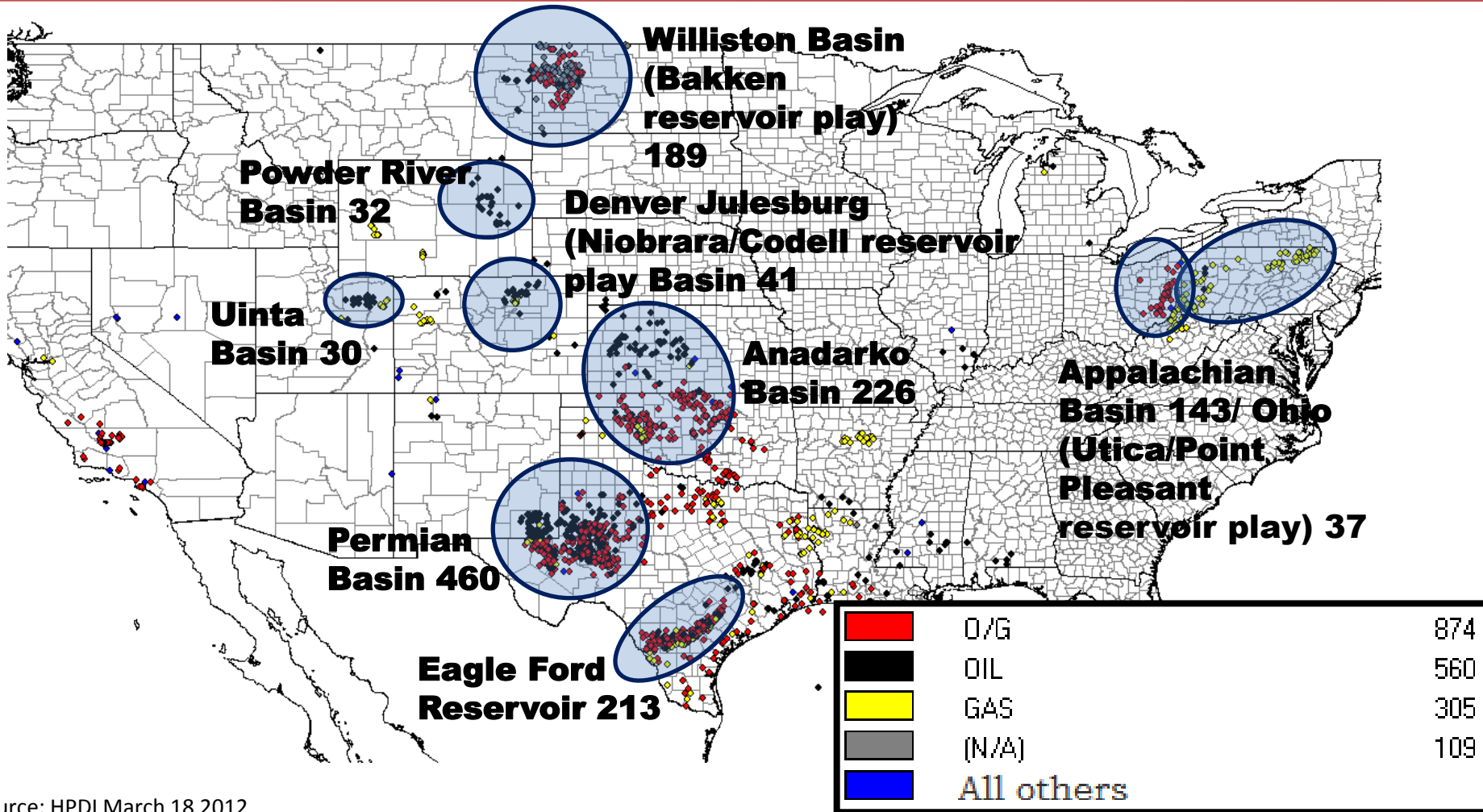
“Net Oil Imports in Selected Countries and Regions in the New Policies Scenario”

Remember to be humble...Projected Imports of LNG vs. Actual



Source : EIA data and forecasts

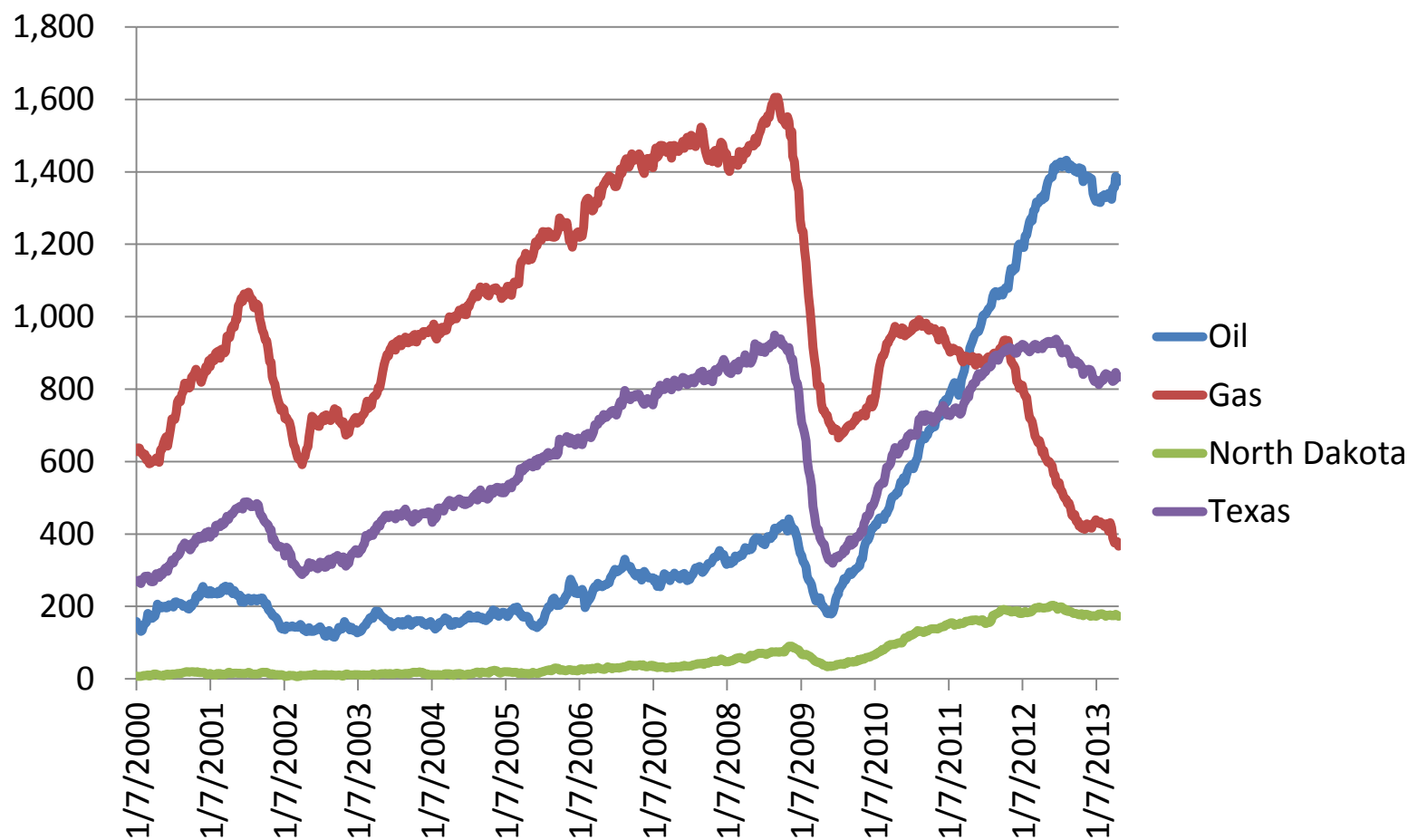
U.S. Rig Count and Play Breakdown with Rig Totals



Source: HPDI March 18 2012

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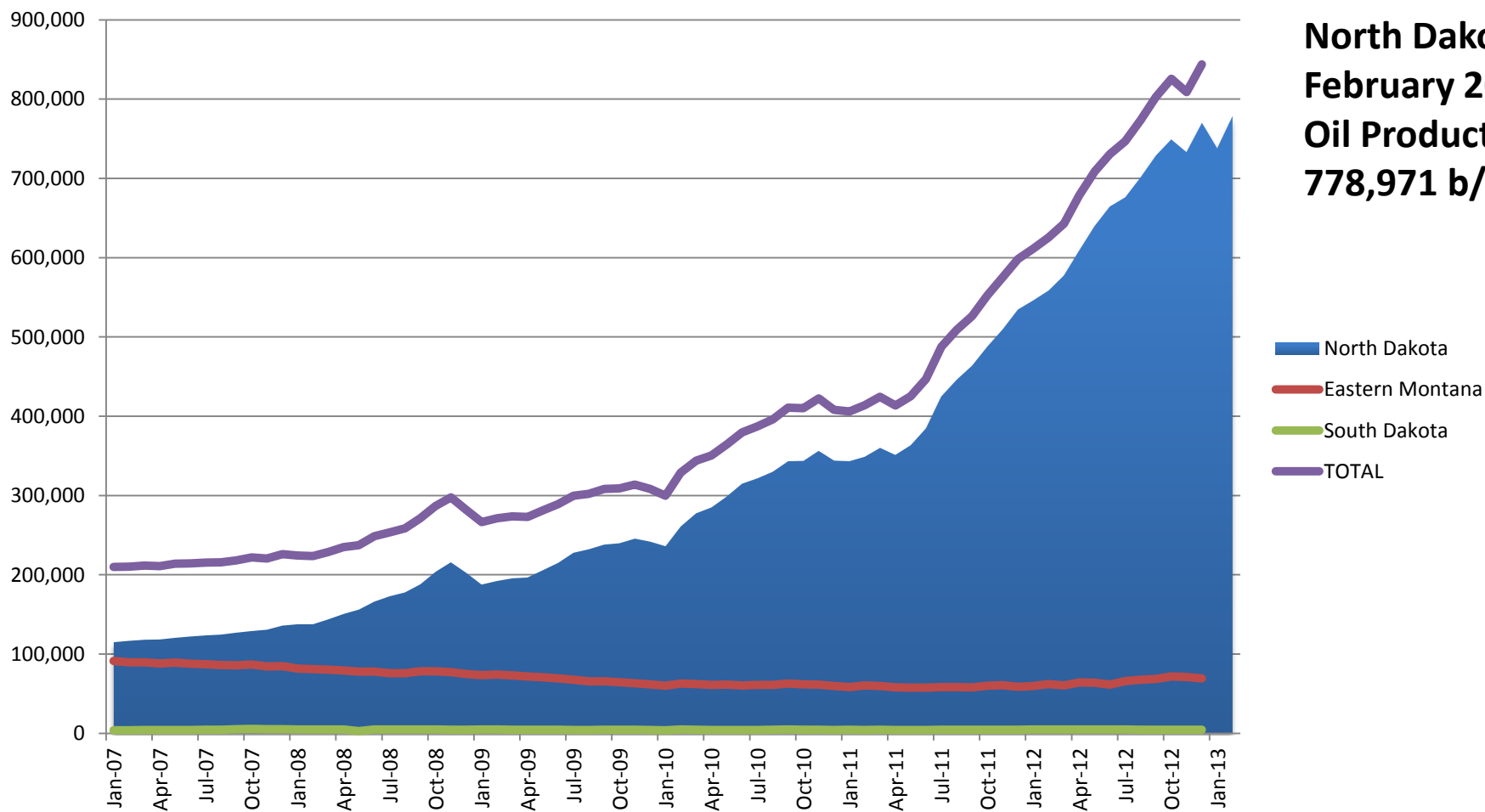
U.S. and North Dakota and Texas Rig Count



Source: Baker Hughes Jan 2013. All but 51 rigs nationwide are onshore.

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North Dakota Oil Production



Source: NDPA

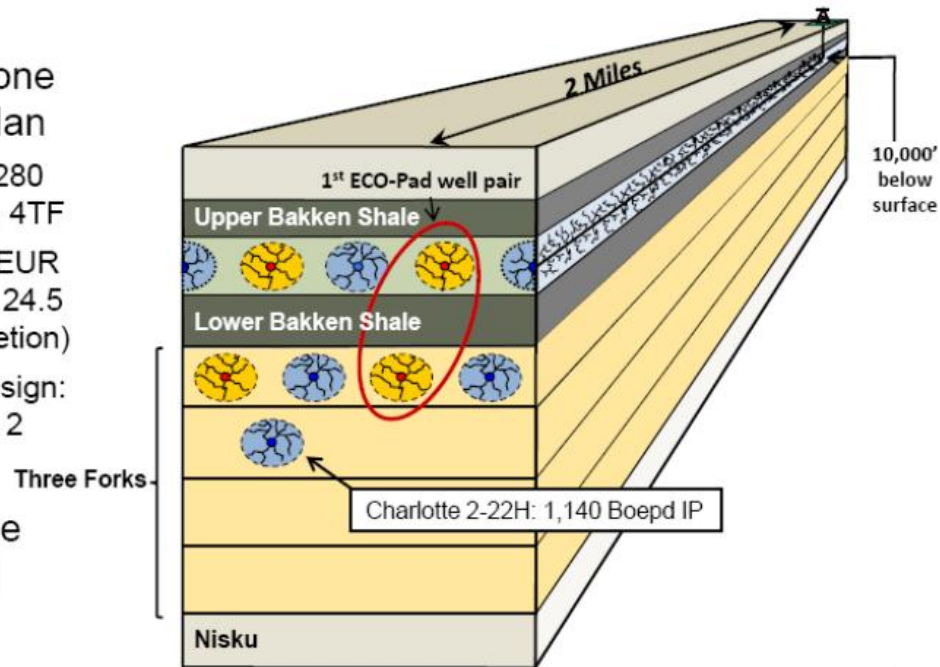
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A lot of potential...

Bakken Development Plan

- 🔥 Original dual-zone development plan
 - 8 wells per 1,280 acres – 4 MB, 4TF
 - 603,000 Boe EUR per well (avg. 24.5 stages/completion)
 - ECO-Pad® design: 2 wells south, 2 wells north

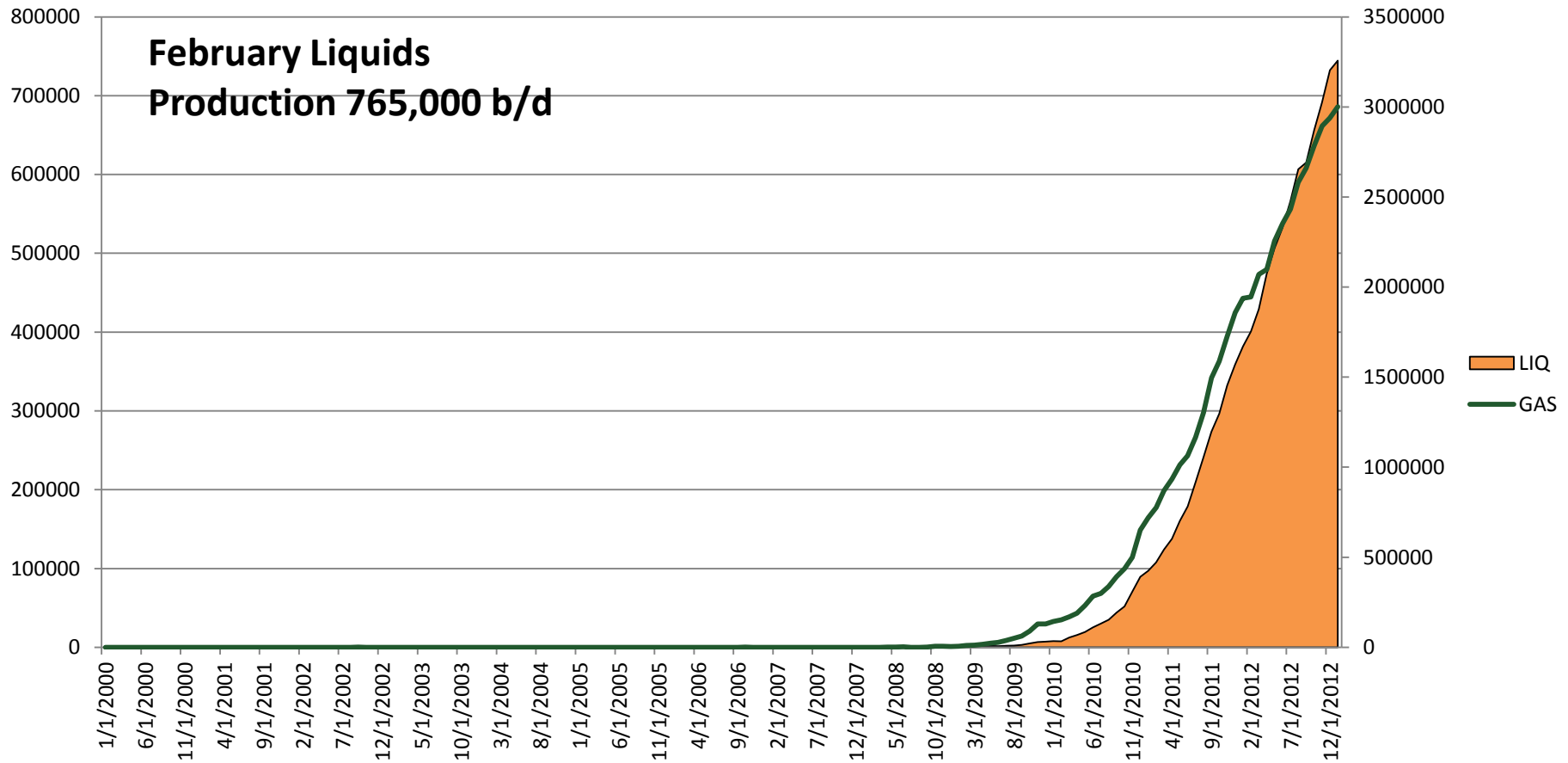
- 🔥 Additional Three Forks potential



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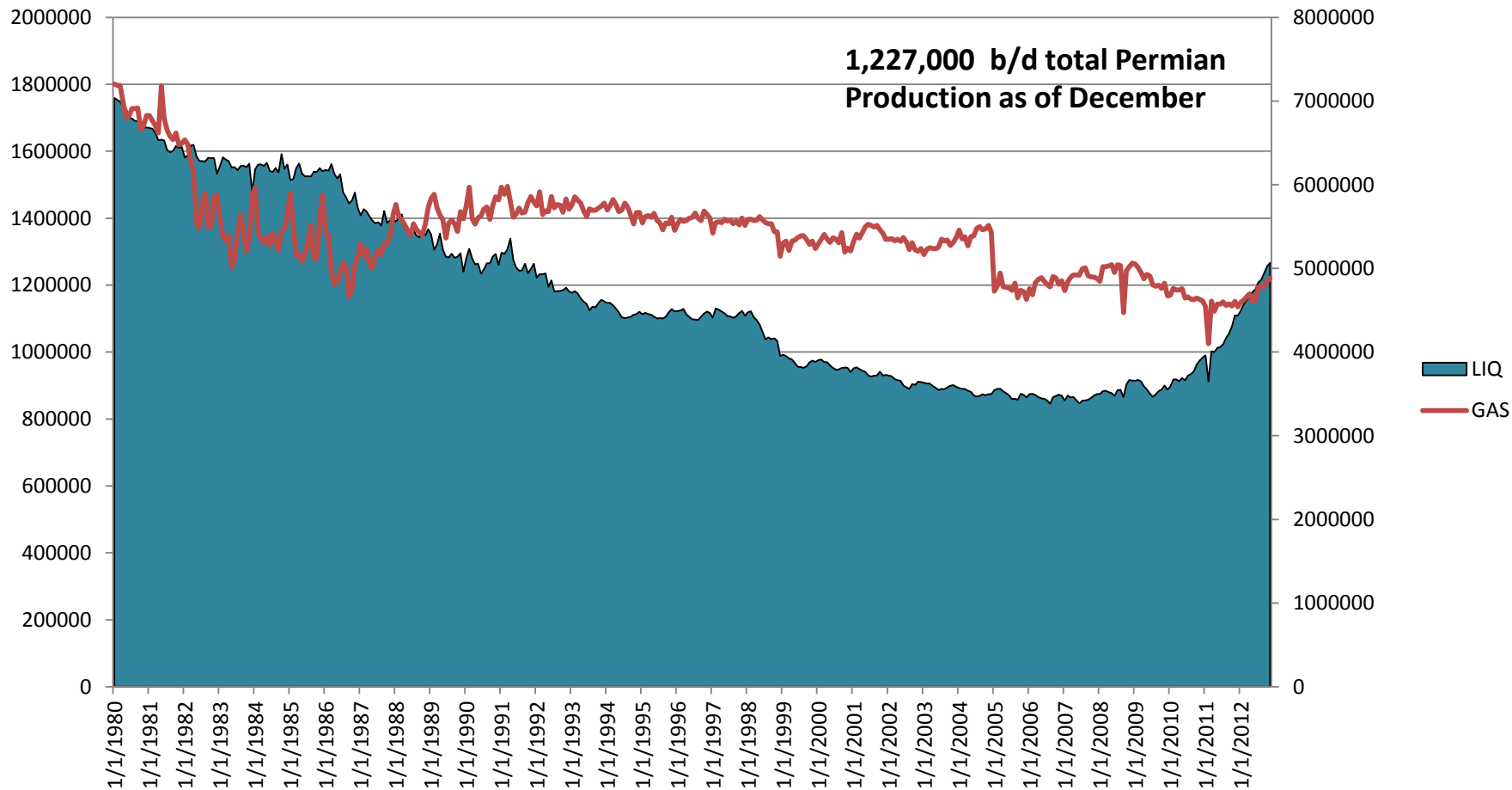


South Texas' Eagle Ford Production



Source: HPDI, liquid volumes includes condensate, estimated condensate volumes are up to 40% of liquids production

Permian Basin Production



Source: HPDI Jan 2013

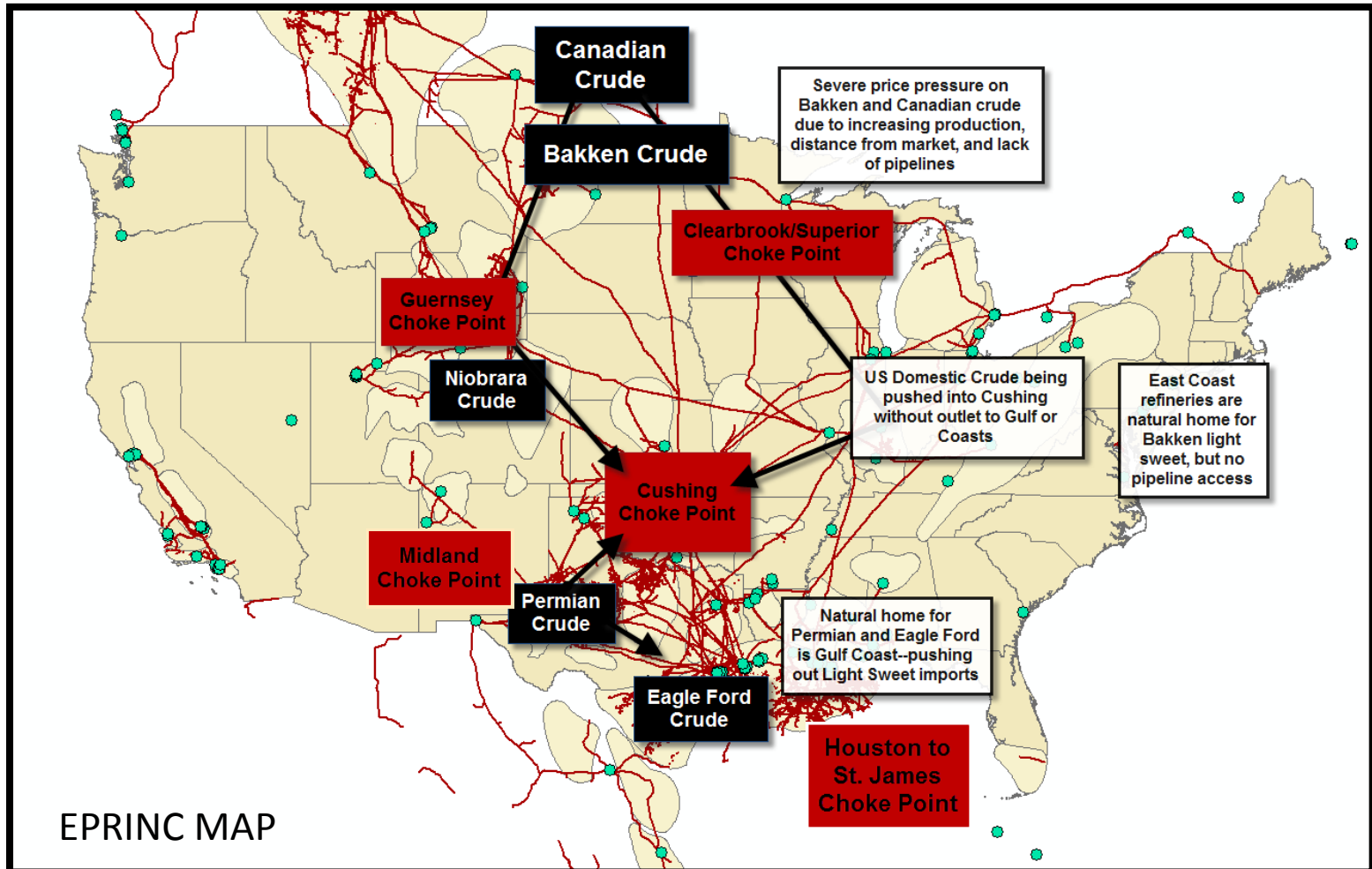
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Understanding the Infrastructure

Markets for Bakken and Canadian Crude

- The current markets for Canadian crude are the Rockies (PADD 4) and the Midwest (PADD 2) where heavy and SCO (synthetic/syncrude) refining capacity exists
- The potential exists in Asia and the Gulf Coast (substantially knocking out heavy Mexican and Venezuelan imports in the US Gulf Coast) as well as the West 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 from the U.S. exacerbating this tightness
- The U.S. imports a significant amount of SCO as well as heavy crude oil from Canada. SCO could play an important role in blending and meeting desired production of distillate for refineries.
- Canadian crude DID fight for capacity with Bakken crude along the Enbridge line (Bakken crude ends up in Clearbrook and all of the PADDs)---as Bakken crude has moved to rail, Canadian price discounts have eased slightly, but this correction maybe overdone (and a result of oil sand start up delays and upgrader issues etc...)

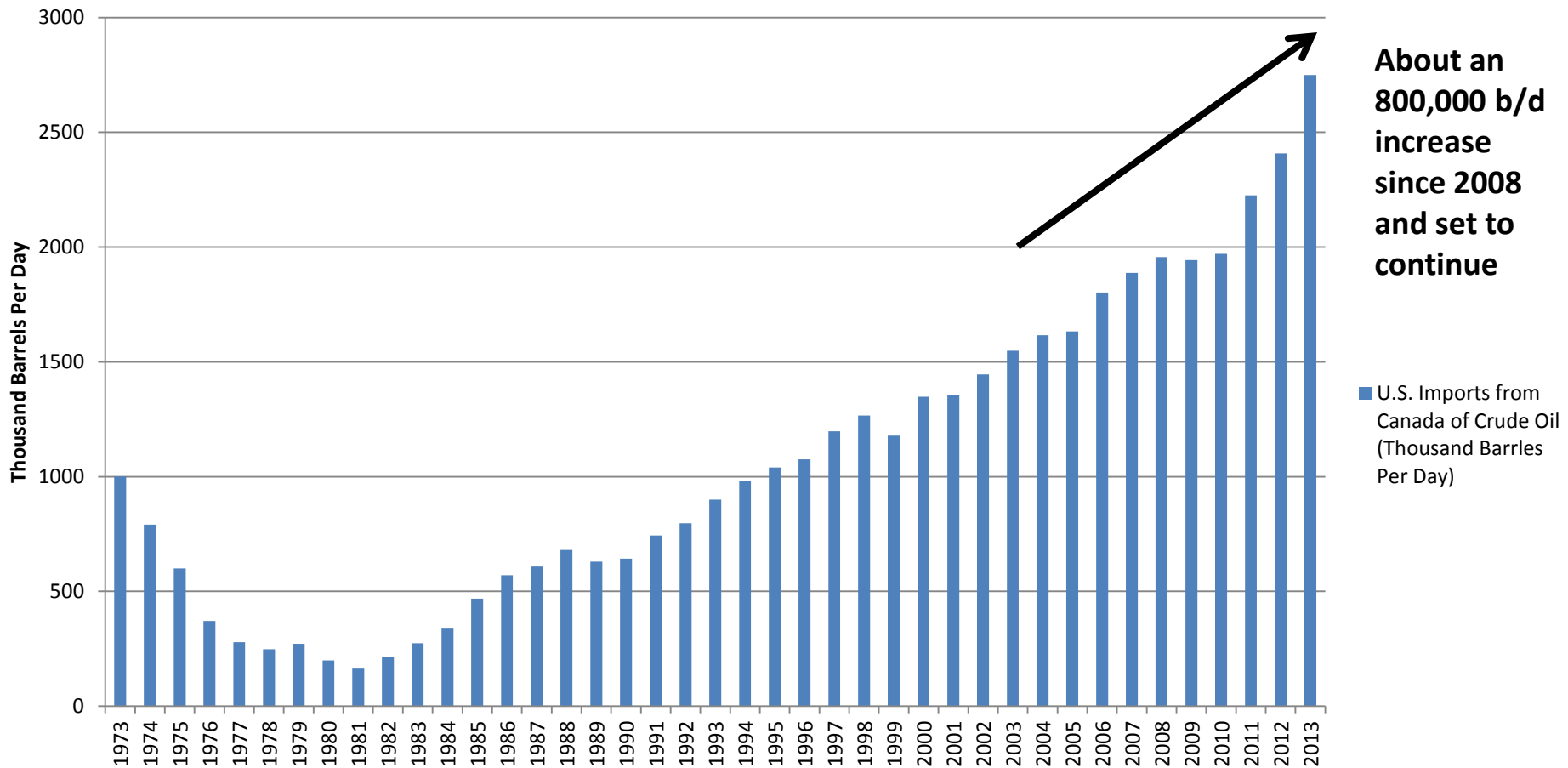
Choke Points



Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software

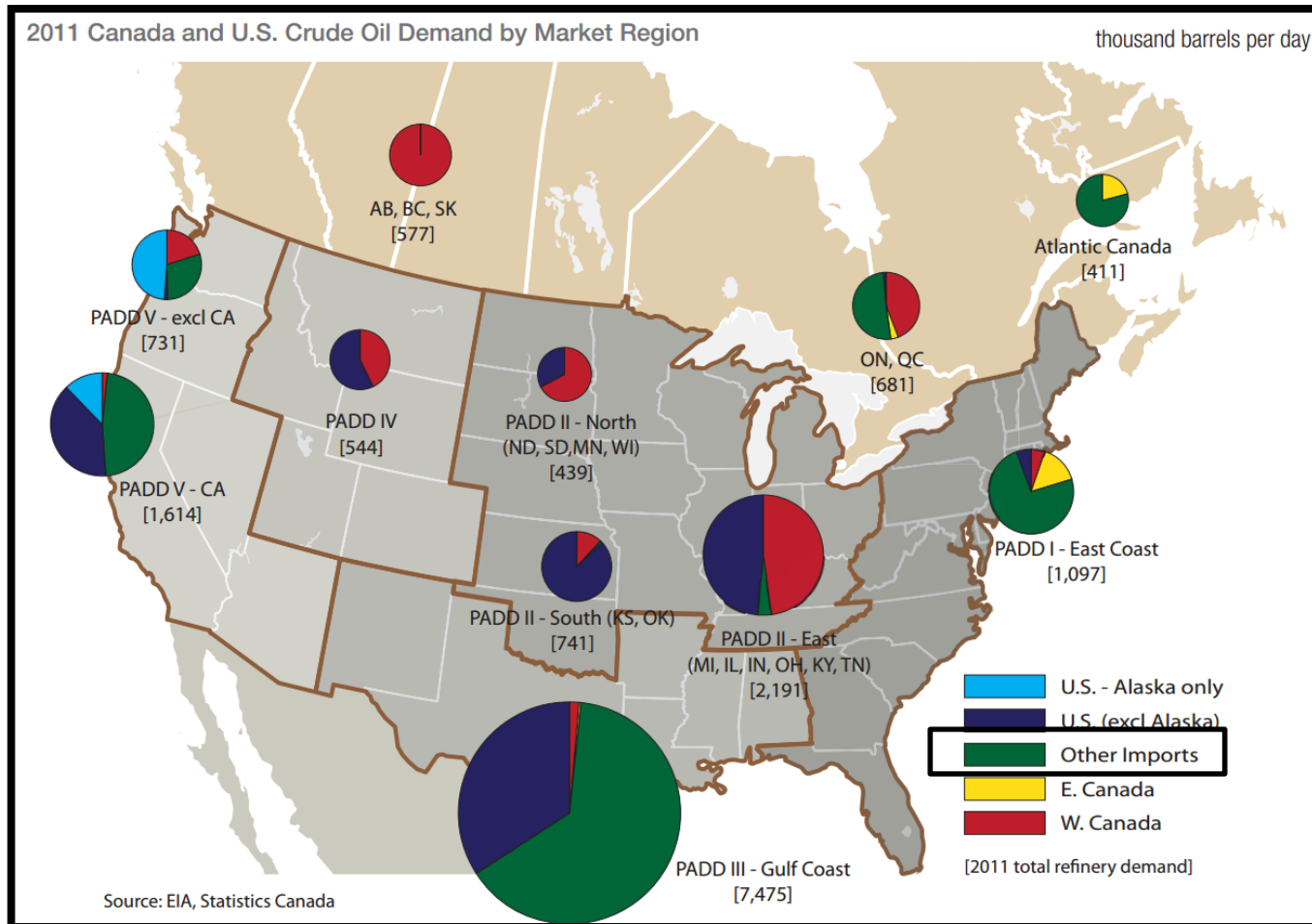
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U.S. Imports of Canadian Crude



Source: EIA

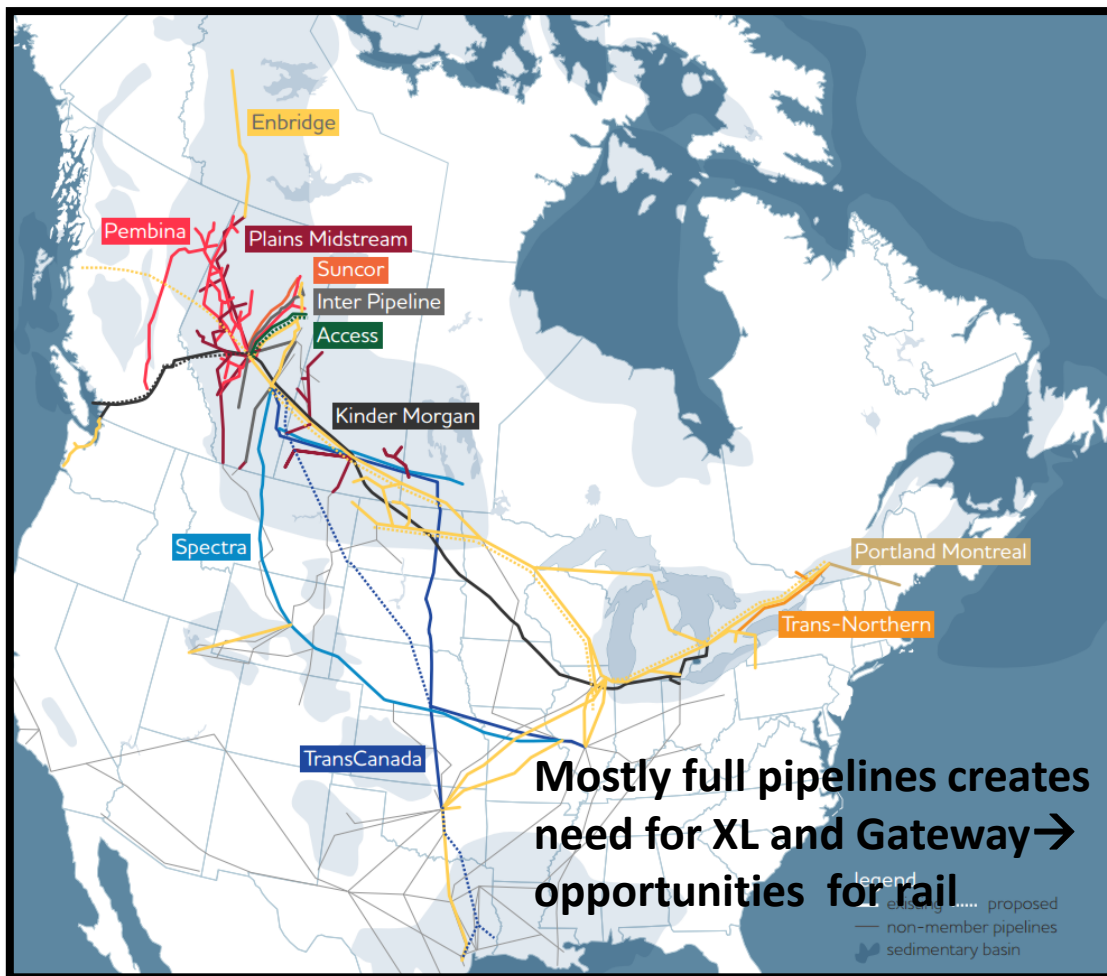
Canadian Imports and Potential Markets



Source: CAPP Crude Oil Forecast June 2012

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Canadian Pipeline Export Options

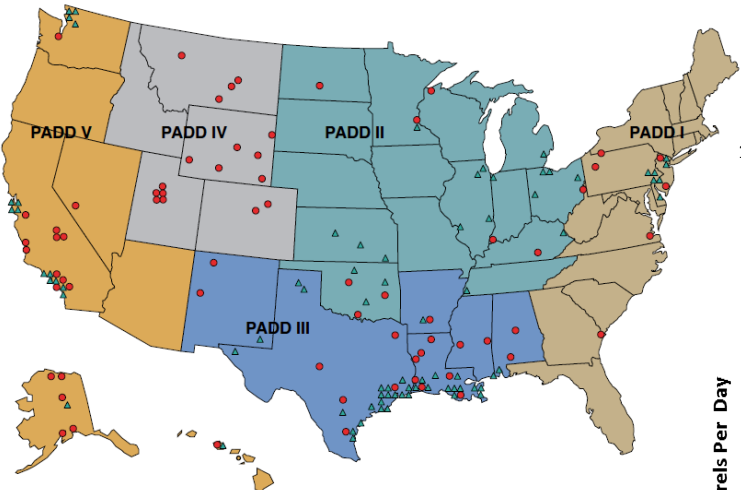


- **Kinder Morgan's** Transmountain line off BC coast- currently 300,000 b/d capacity-recent announcements to expand up to 800,000 b/d (early 2017)
- (Now Spectra) Platte line to Wood River 280,000 b/d-full
- **Enbridge mainline system** currently transporting over 1.5 mbd with potential capacity around 2.5 mbd—Northern Gateway off BC coast planned 525,000 b/d
- **TransCanada's Keystone** 581,000 b/d-full—XL would add 700,000 b/d

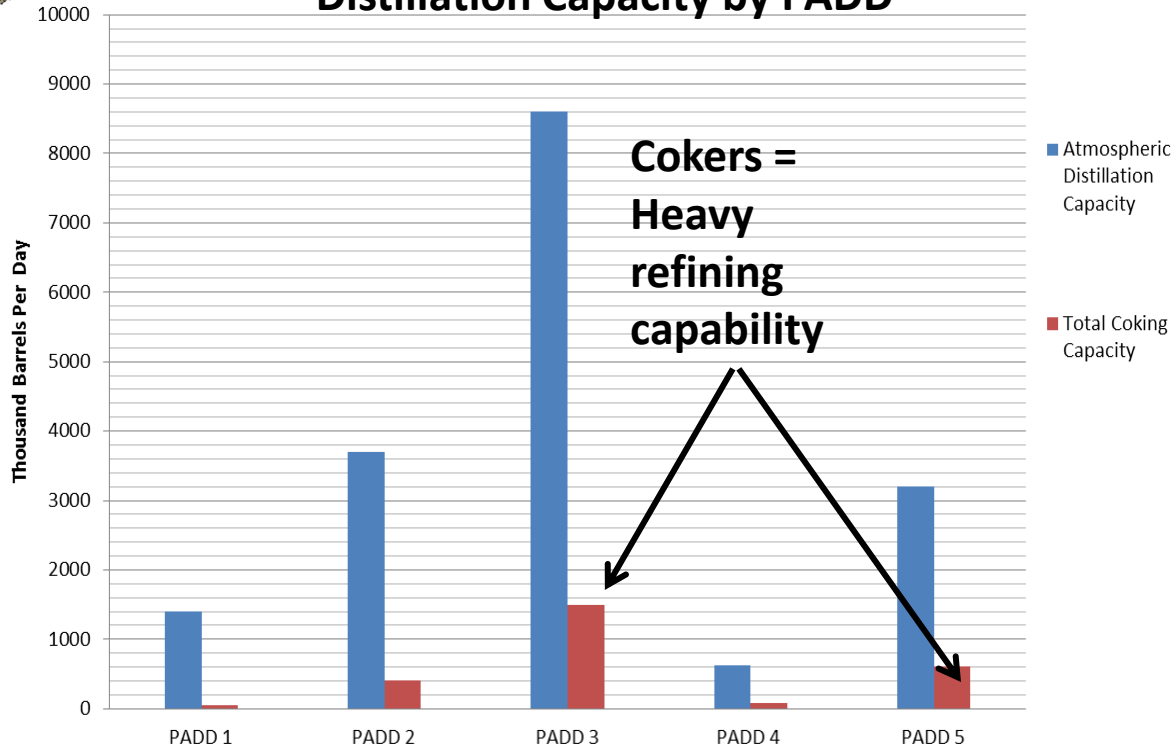
Source: Canadian Energy Pipeline Association

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Where light sweet Bakken and heavy (blended bitumen) needs to go...

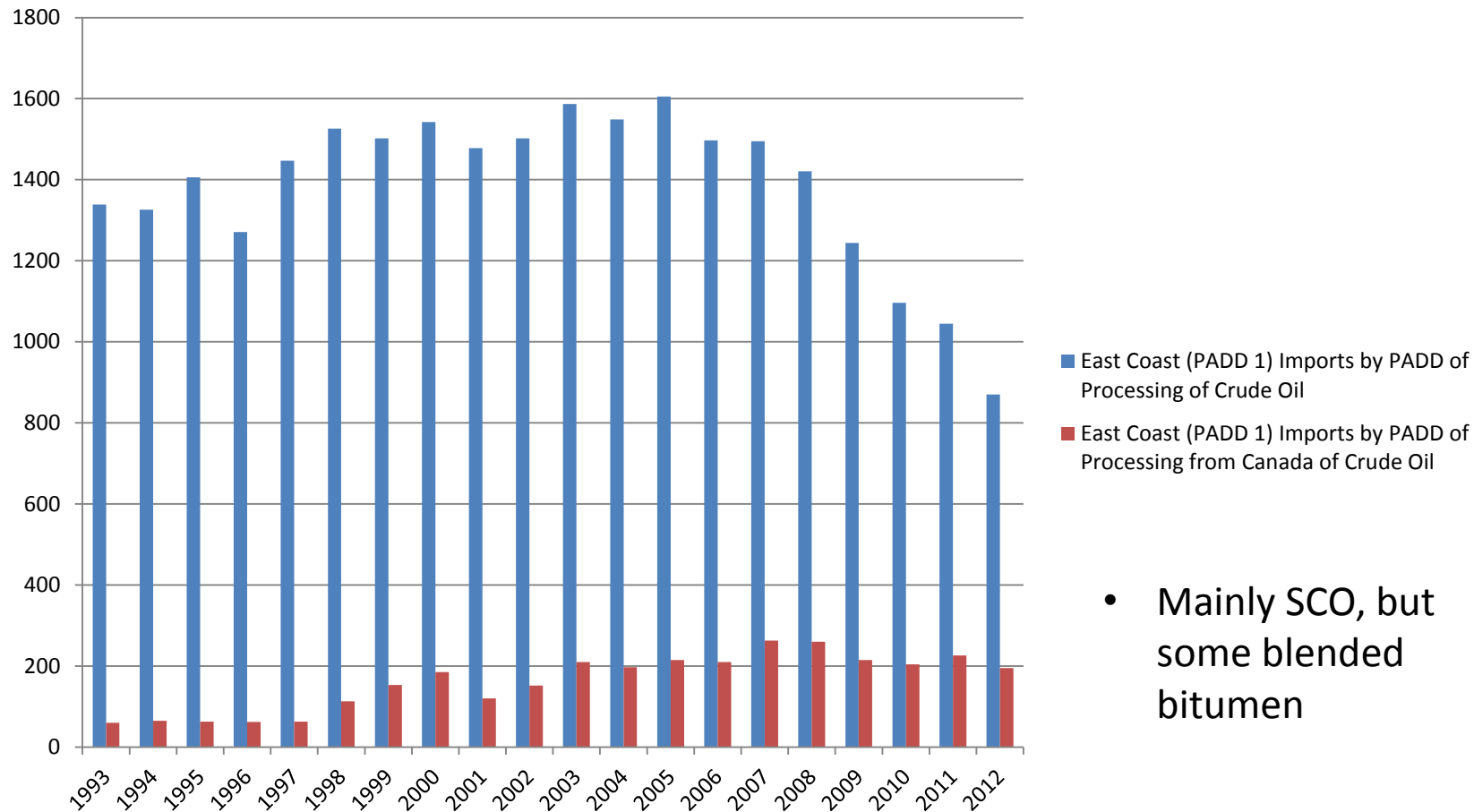


Total Coking Capacity vs. Atmospheric Crude Distillation Capacity by PADD



Source: AFPM map, EIA data for graph

East Coast taking little Canadian Crude

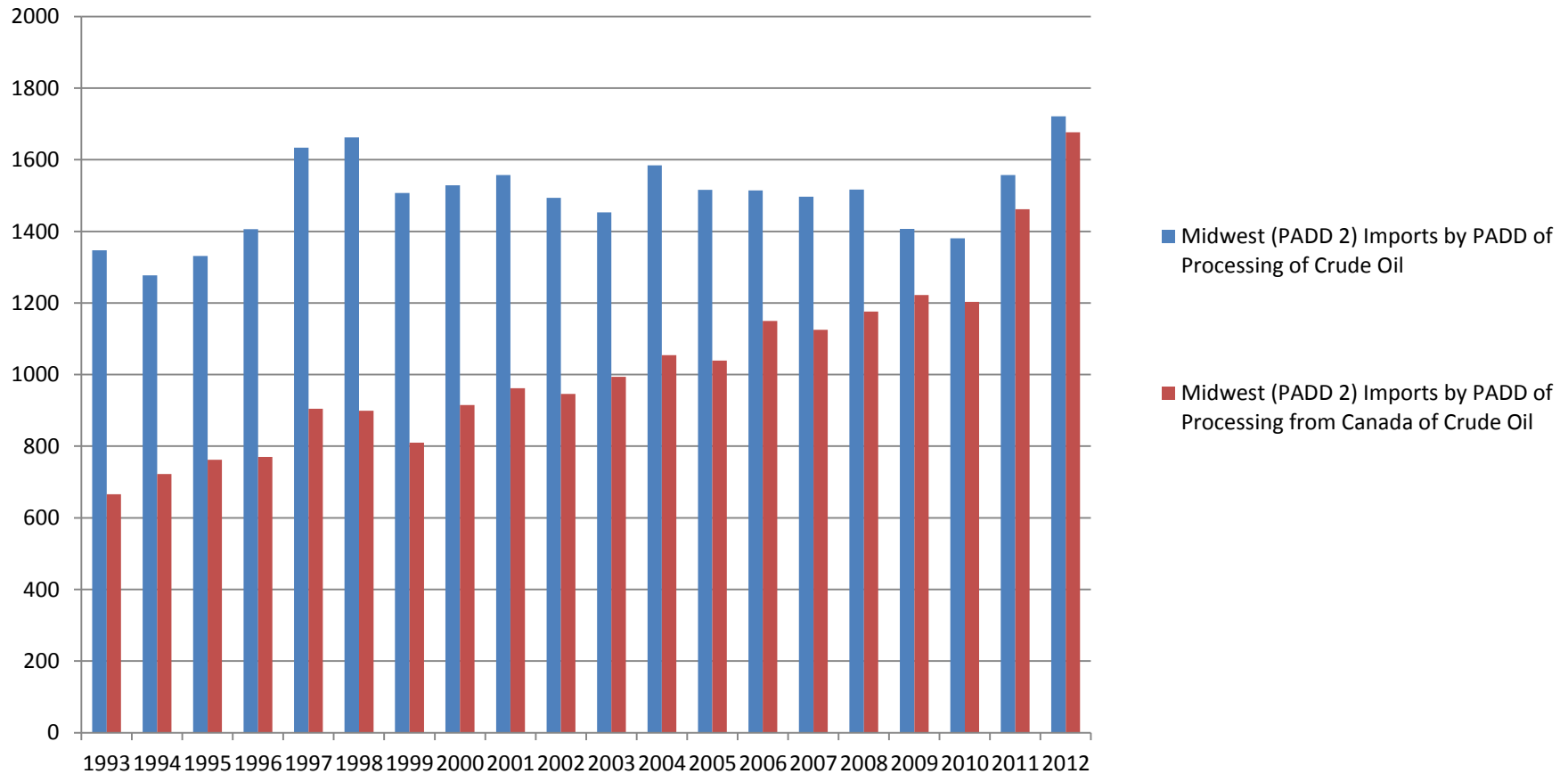


- Mainly SCO, but some blended bitumen

Source: EIA

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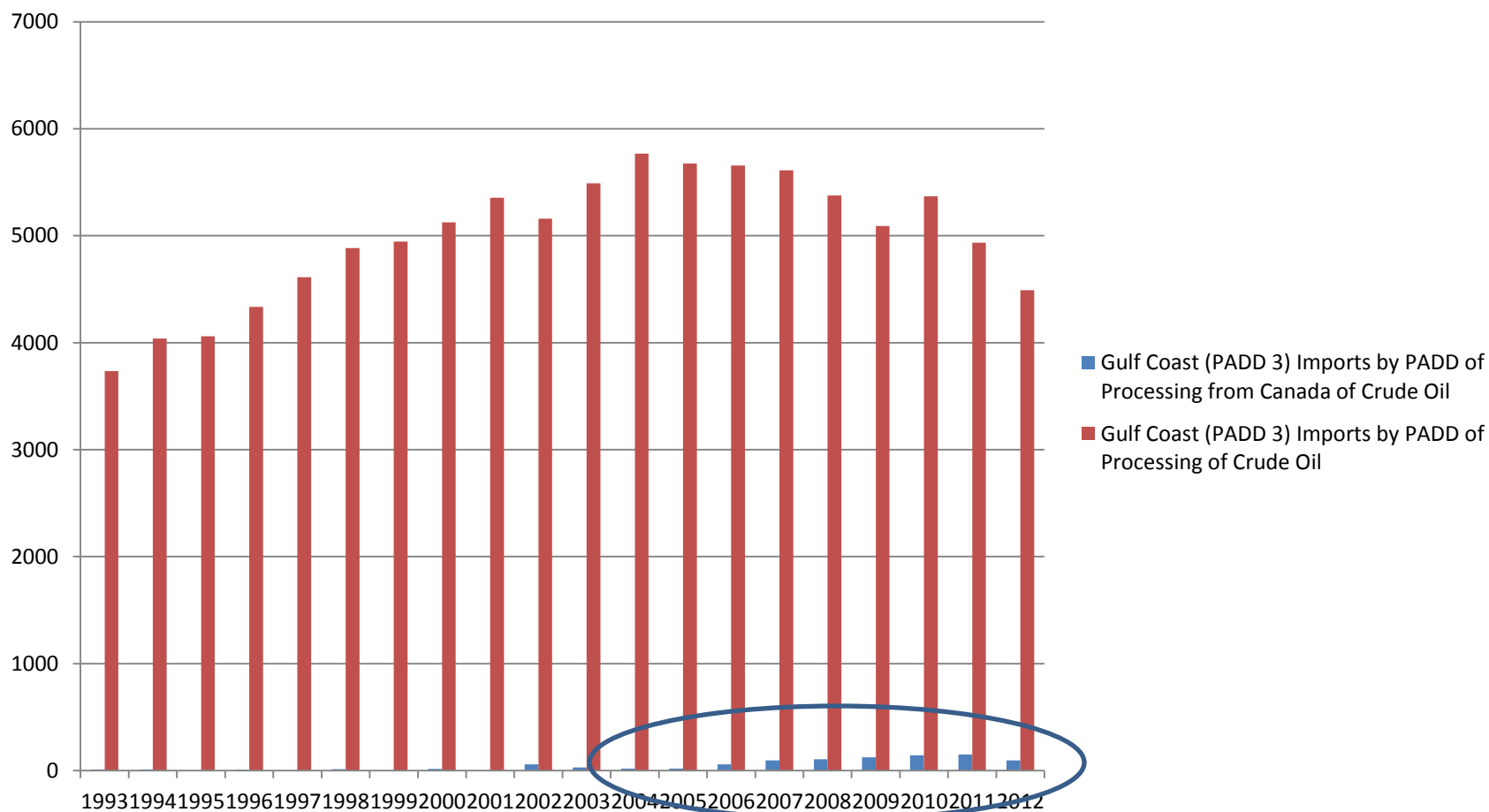
PADD II imports are almost all Canadian



Source: EIA

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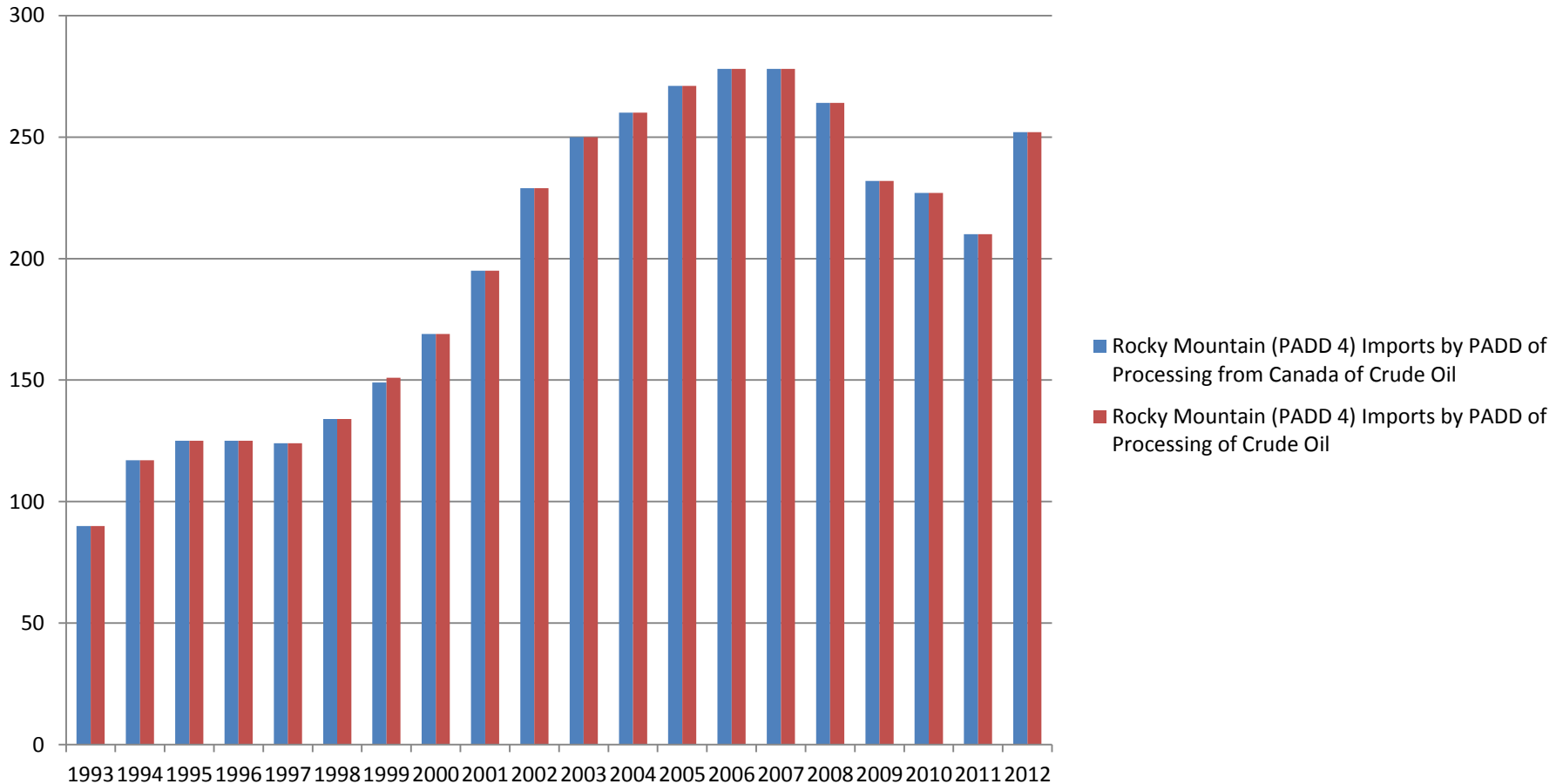
PADD III...has the cokers and is getting none of the crude



Source: EIA

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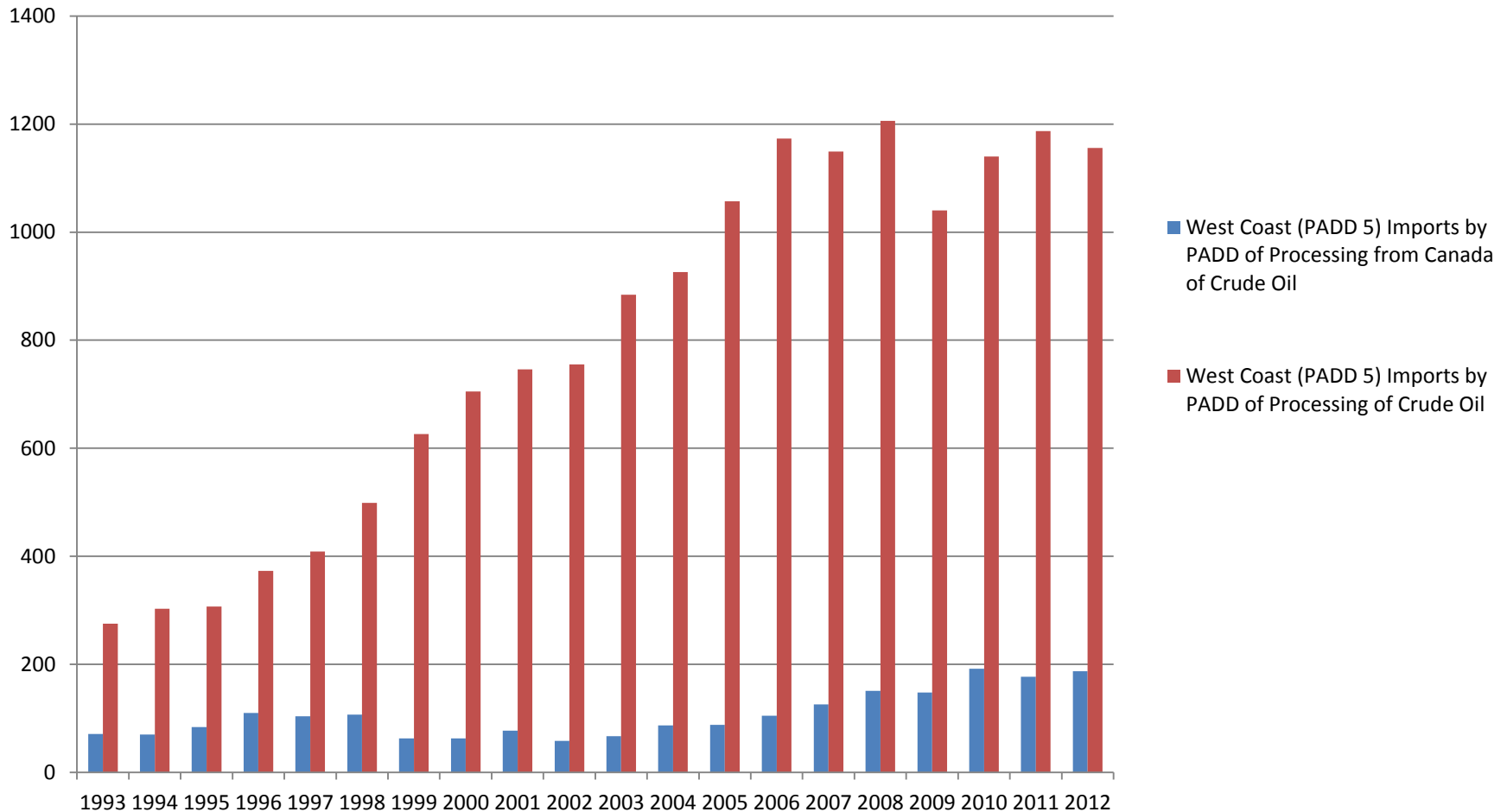
ALL Imports into the Rockies are from CANADA



Source: EIA

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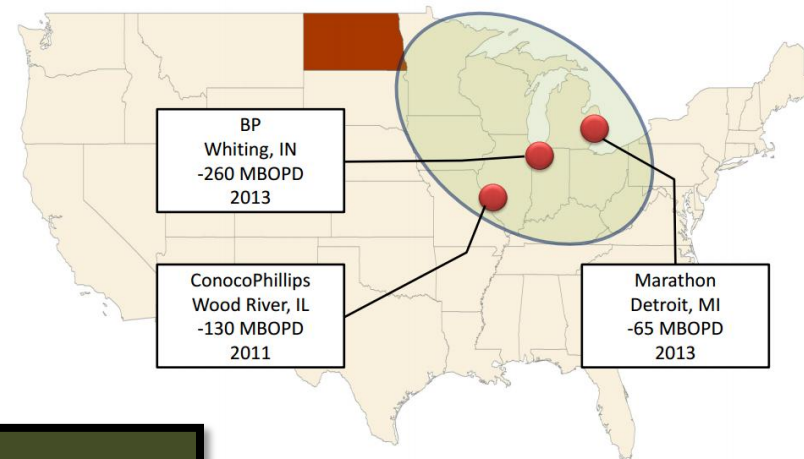
PADD V also has the cokers...taking some Canadian



Source: EIA

PADD II will be importing more HEAVY crude...

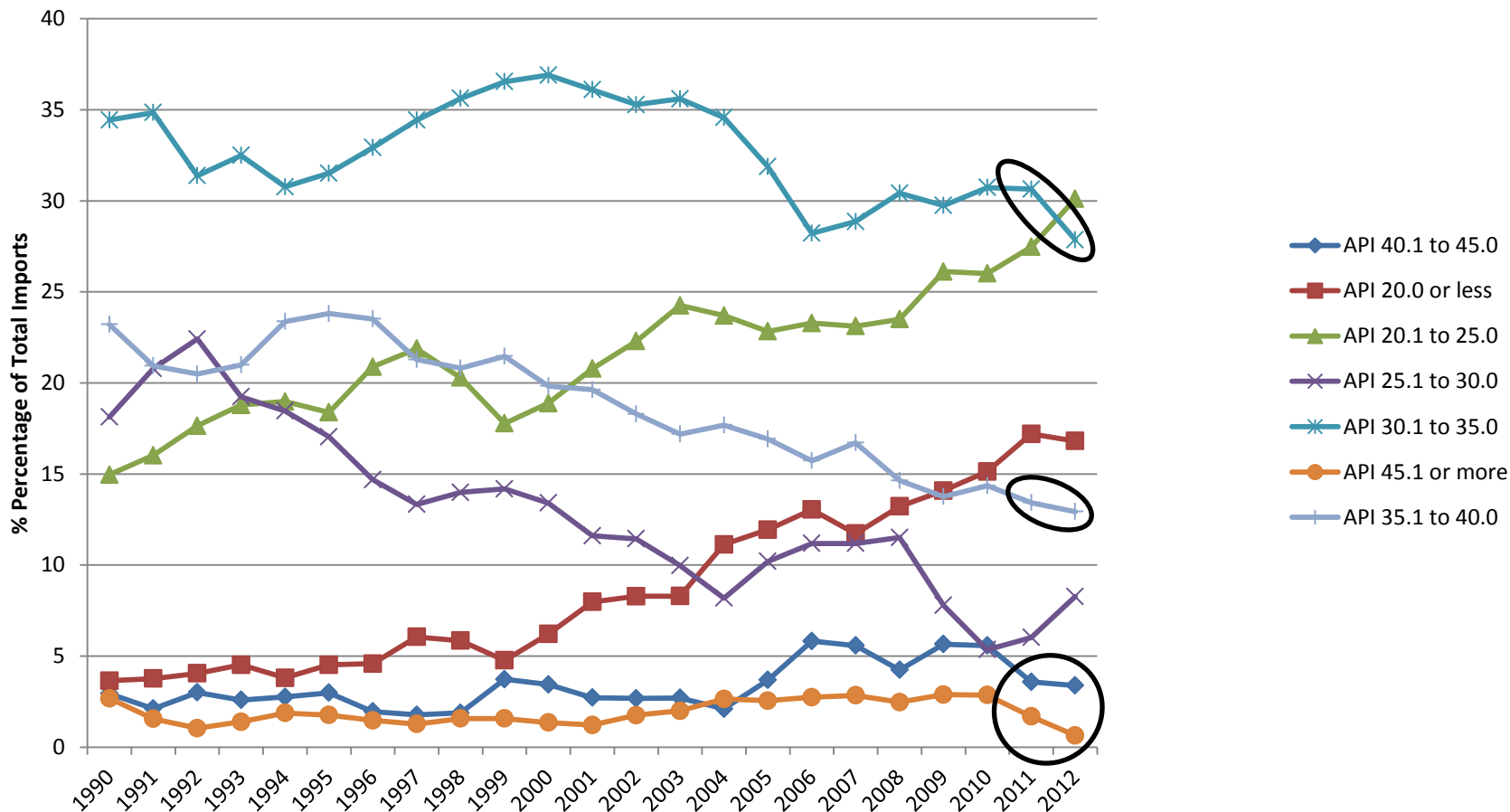
...absorbing more Canadian crude and pushing out light sweet Bakken crude



Refinery	Year	Crude Demand Impact MBPD	
		Light	Heavy
COP/Cenovus Wood River	2012	-95	+130
Marathon/Detroit	2013	-65	+80
BP/Whiting	2013	-220	+260
BP/Husky Toledo	2015	-45	+60
Total		-425	+530

Source: John Auers Turner Mason Argus Americas Crude Summit Jan 2012;; map using Enbridge data from NDPA

U.S. Imports by API Gravity



Source: EIA

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Knocking Out Waterborne Imports

- Growth in domestic crude oil production will largely be light sweet crude oil from tight/shale oil formations such as the Bakken and Eagle Ford.
- If the current rates of growth are maintained, light sweet crude imports into the U.S. will be displaced in the next couple of years.
- By year end, light sweet imports into the Gulf should stop. Bakken should be looking for another coastal home too!
- More imports into the U.S. will be pushed out over the coming years as refiners blend this light sweet crude to meet their specifications (helping to displace medium API gravity imports). The majority of what the U.S. is importing is heavy, medium, and medium and light sour crudes. The demand for heavy crudes in the U.S. should be met by the Canadian oil sands.

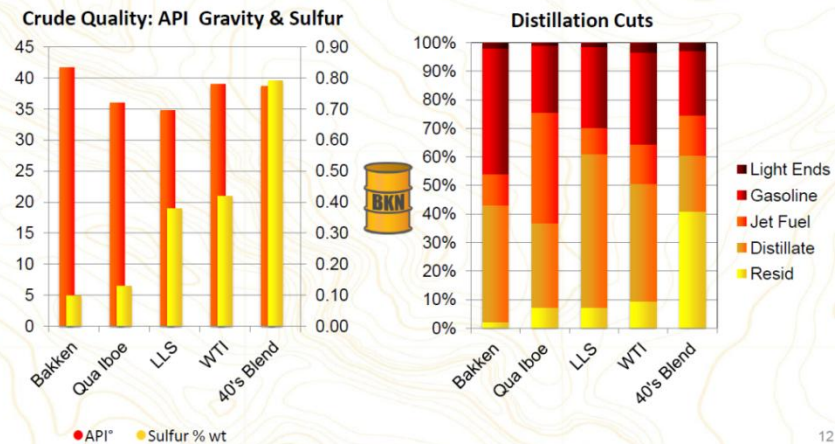
Blending Prospects

Blending is not new to the industry, but blending will be a significant component of the refineries' ability to absorb increasing volumes of light sweet and heavy crudes in the next few years.

	West Texas Sour	50% Cold Lake/ 50% North Dakota Light	Value, \$/Bbl ¹
API Gravity	29.0	31.6	
Sulfur, wt %	1.9	2.0	
Yields, vol %			
- naphtha (IBP-450°F)	35.8	39.2	\$103
- distillate (450°F- 650°F)	20.7	16.4	\$121
- gas oil (650°F- 1000°F)	25.8	23.7	\$110
- residuum (1000°F+)	17.7	20.6	\$92

¹ Based on mid-December prices

Bakken Premium Light Sweet Crude vs. Other Benchmarks Improved Refinery Yield

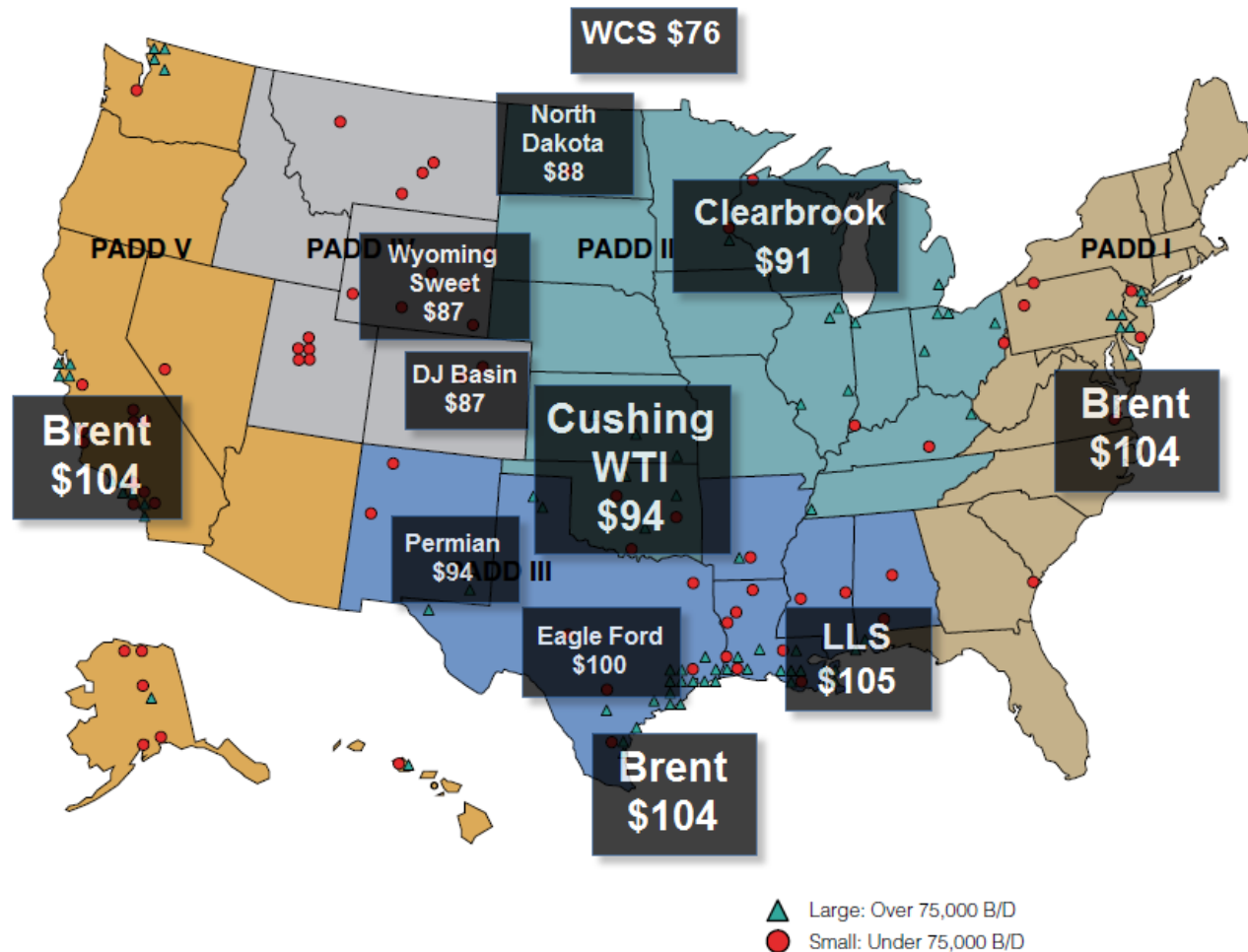


Source: Dennis Sutton Marathon, Argus Americas Crude Summit Jan 2012; Continental Resources 2013 Investor Presentation

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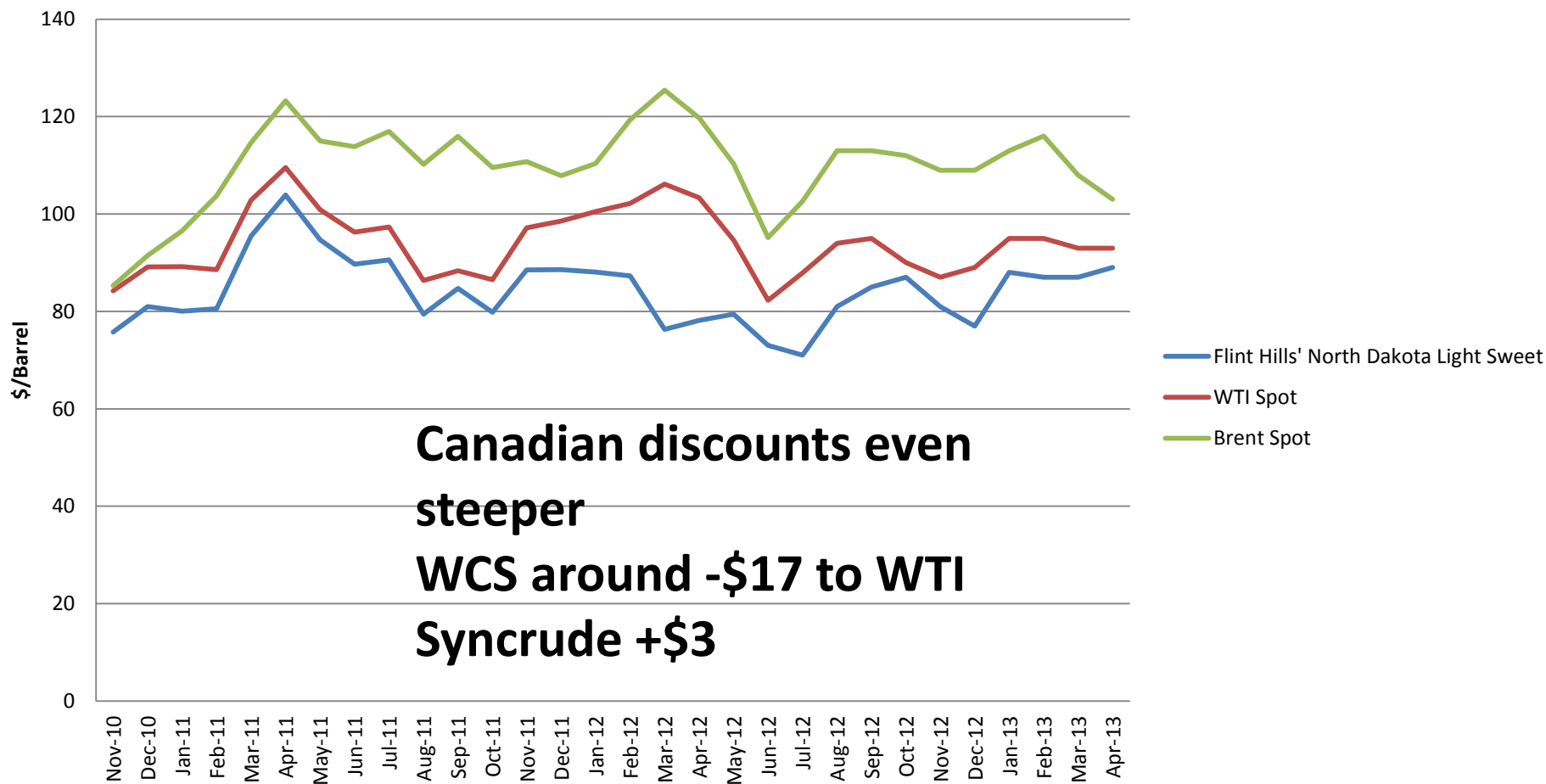
**And with all this production
what's happening to prices?**

Regional Pricing Disparities



Source: AFPM Map,; Bloomberg Brent, midland, LLS, and WTI prices, (estimates), Permian and estimates, Canadian assumptions and estimates (Bloomberg) emitte lucem et veritatem

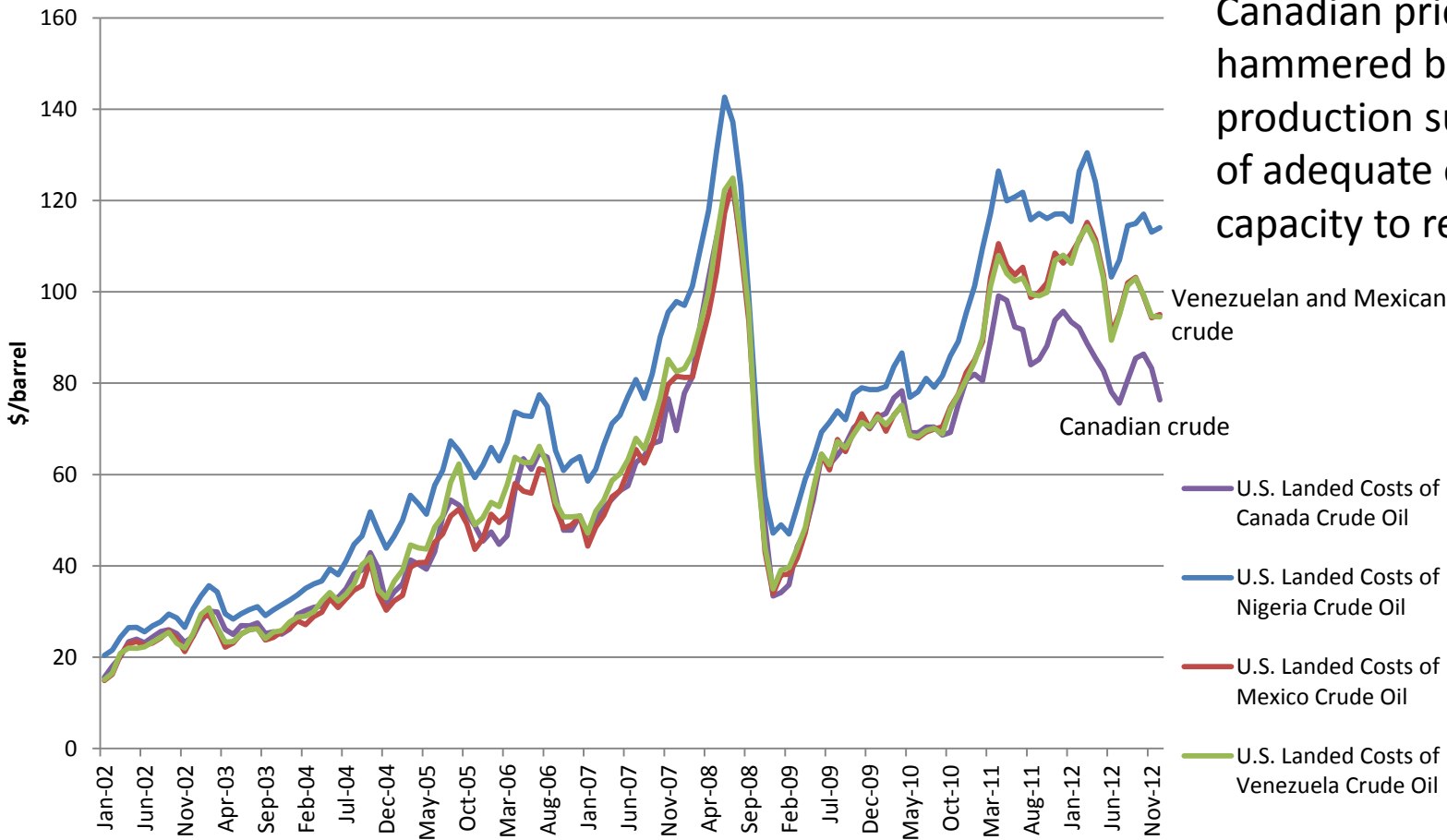
Price Discounts



Source: Flint Hills, EIA, and estimates

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Price of Canadian Crude Imports



Canadian prices being hammered by U.S. production surge and lack of adequate outbound capacity to refining centers

Venezuelan and Mexican crude

Canadian crude

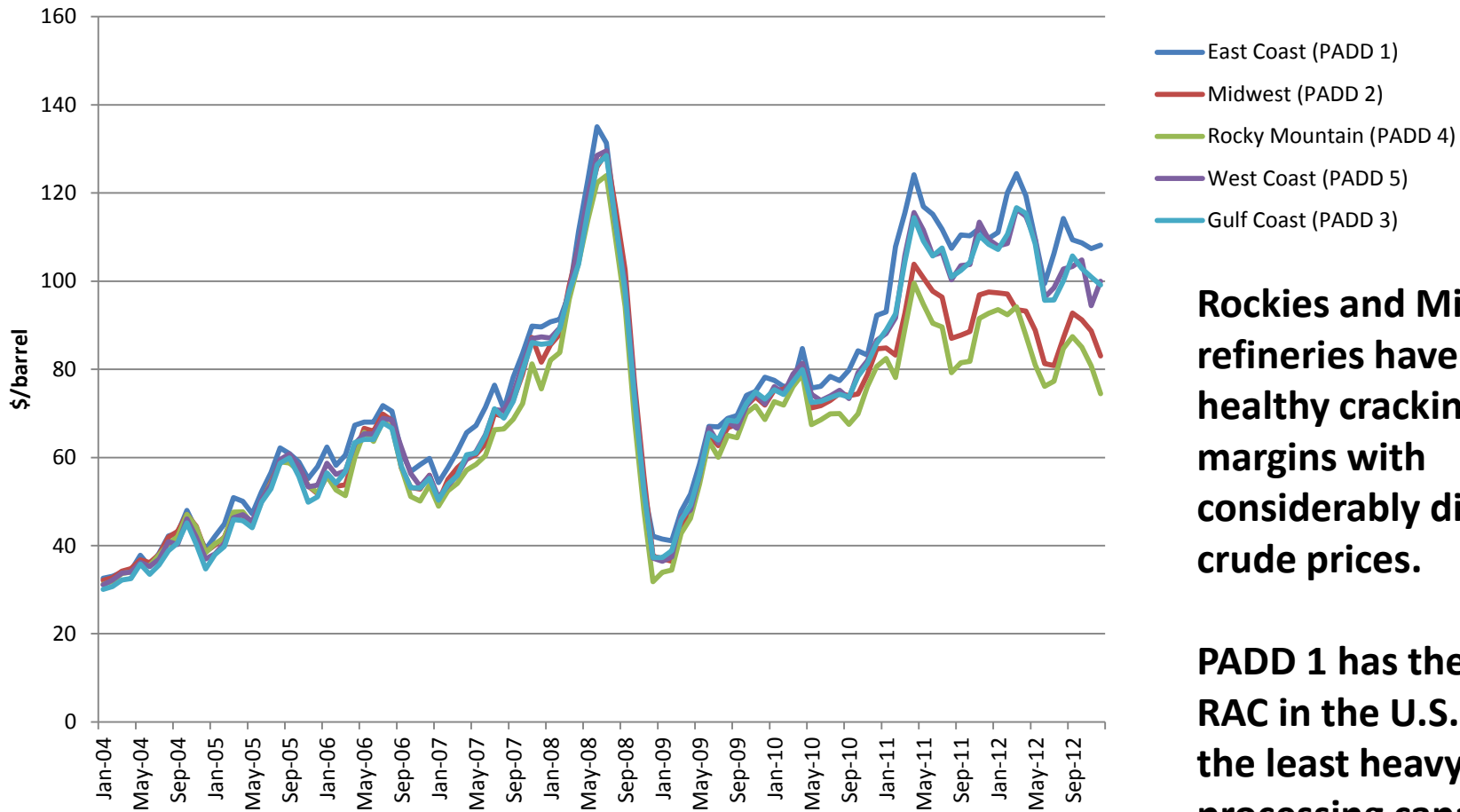
- U.S. Landed Costs of Canada Crude Oil
- U.S. Landed Costs of Nigeria Crude Oil
- U.S. Landed Costs of Mexico Crude Oil
- U.S. Landed Costs of Venezuela Crude Oil

Landed Cost: "The dollar per barrel price of crude oil at the port of discharge. Includes charges associated with the purchase, transportation, and insuring of a cargo from the purchase point to the port of discharge. Does not include charges incurred at the discharge port (e.g., import tariffs or fees, wharfage charges, and demurrage)."

Source: EIA

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Refinery Acquisition Cost of Crude Oil

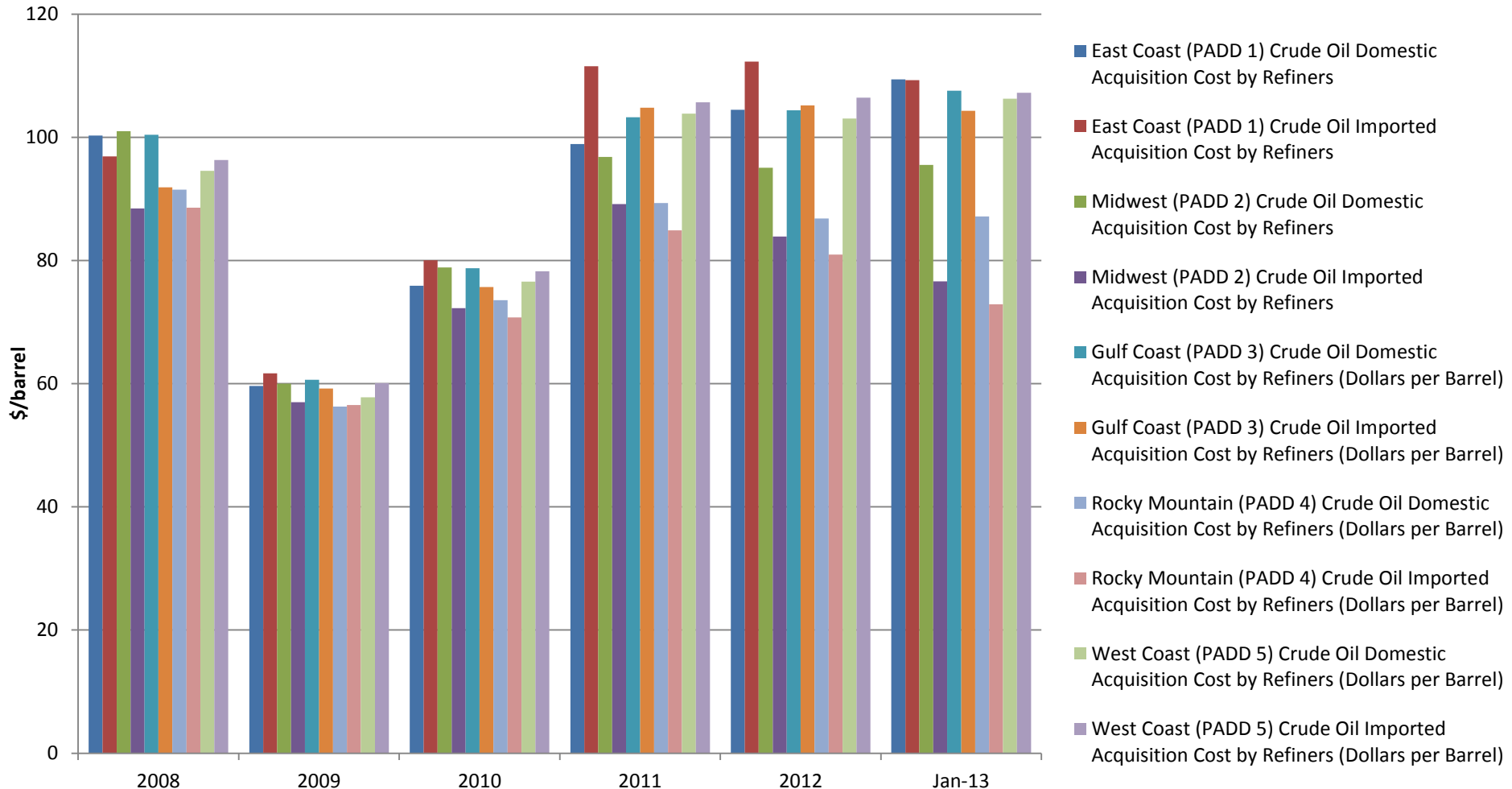


Rockies and Midwest refineries have enjoyed healthy cracking margins with considerably discounted crude prices.

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

Source: EIA

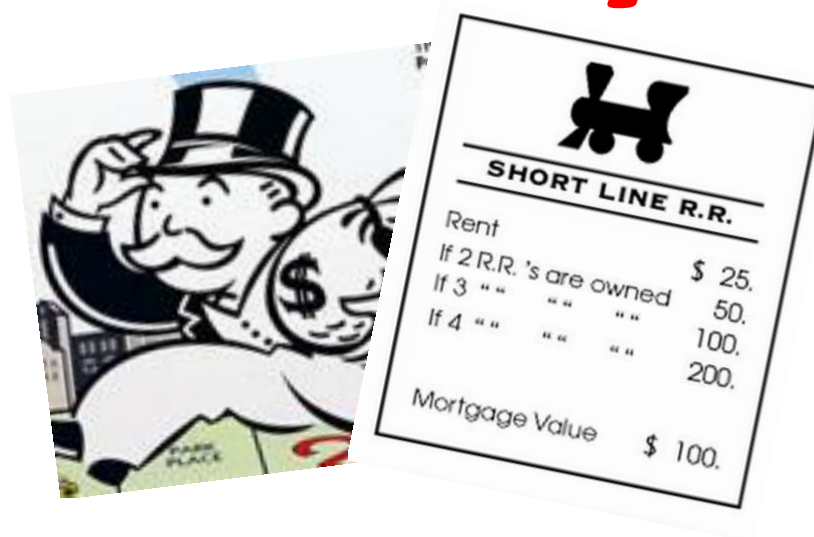
RAC Domestic vs. Imported



Source: EIA Data

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Railroads Come to Play



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From Wellhead to Railbed

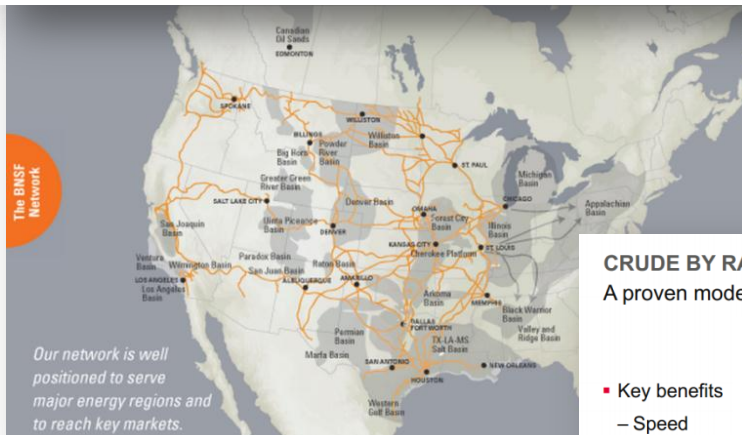
- Over 600,000 b/d of crude are moving by rail out of the Williston Basin
- 300,000 b/d of spare pipeline capacity out of ND (estimated)
- Bakken crude making it to all US coasts (and all PADDs)
- East Coast refiner PBF Energy beginning to take heavy oil sands crude via rail
- Over 2 mbd (million barrels a day) of crude oil and petroleum products are moving by rail in the US and Canada
- Statoil leasing 1,000 railcars; Exxon leasing 2,000 railcars (rumored 10,000 car purchase); Valero leasing 2,000 railcars
- Major refiner Phillips 66 signing 5 year contract with Global Partners
- Many refineries gearing up to take crude by rail—initially by manifest and then via unit trains
 - Multiple refineries waiting on permits for rail terminals in California
- Around 150,000 b/d of Canadian crude are moving by rail
 - Small oil sand operators are putting entire production on rail

Rail is a Contender

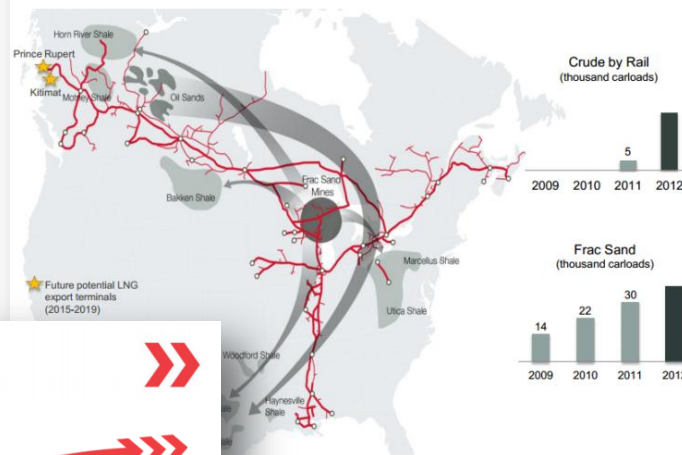
News Release

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

FORT WORTH, Texas, September 4, 2012:



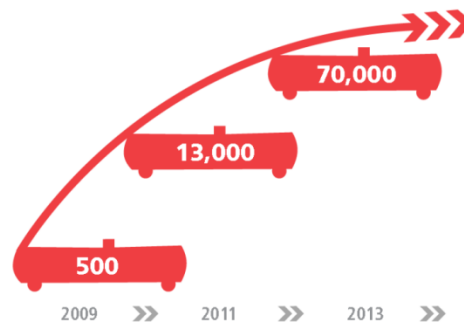
Energy – Significant Opportunities



CRUDE BY RAIL

A proven model with growing demand

- Key benefits
 - Speed
 - Capacity
 - Flexibility
 - Optionality
 - Scalability



CANADIAN PACIFIC

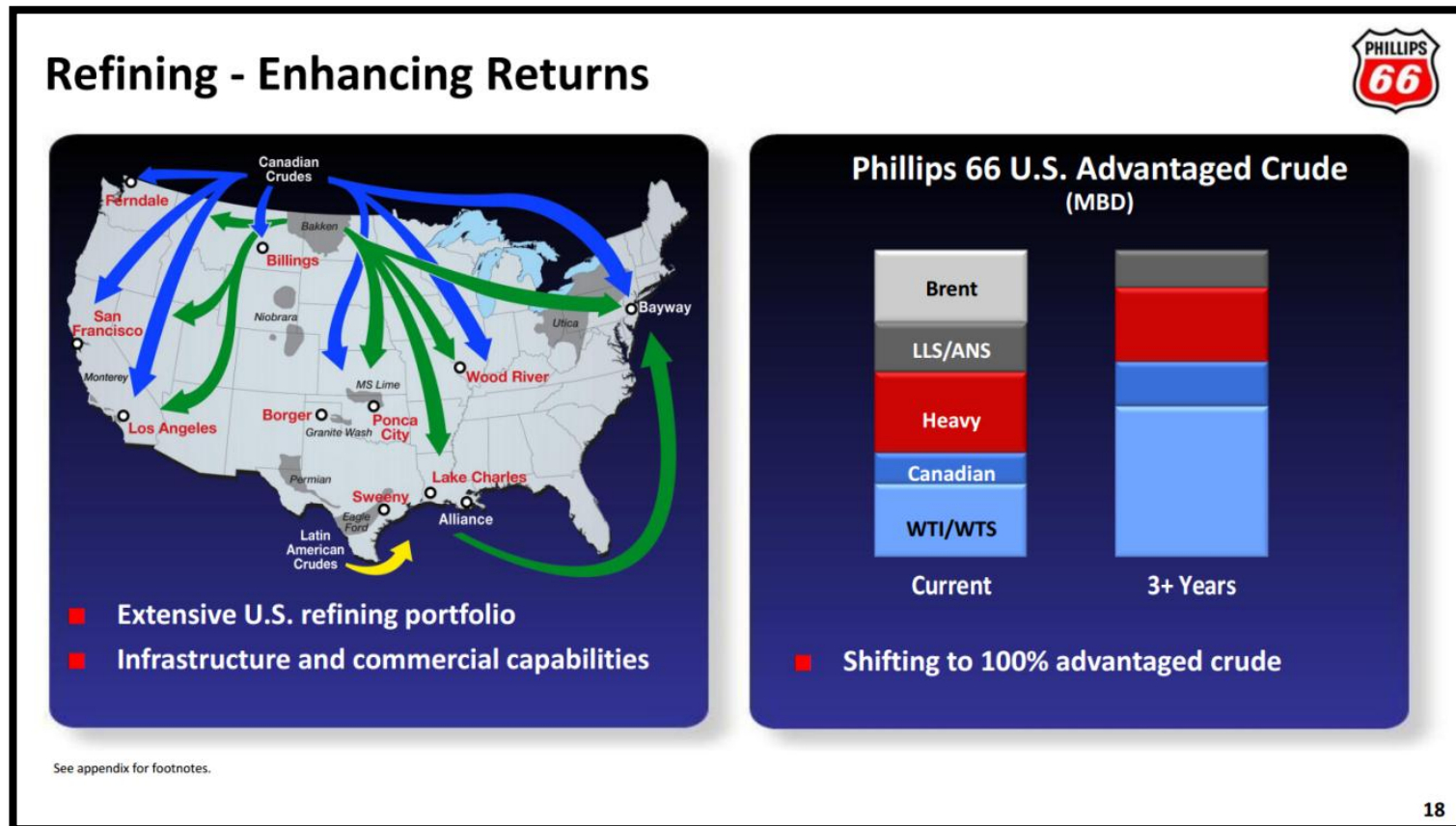
TSX/NYSE | CP 12

Source: Images directly from BNSF, CP, and CN websites

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Refineries aggressively seeking advantaged crude

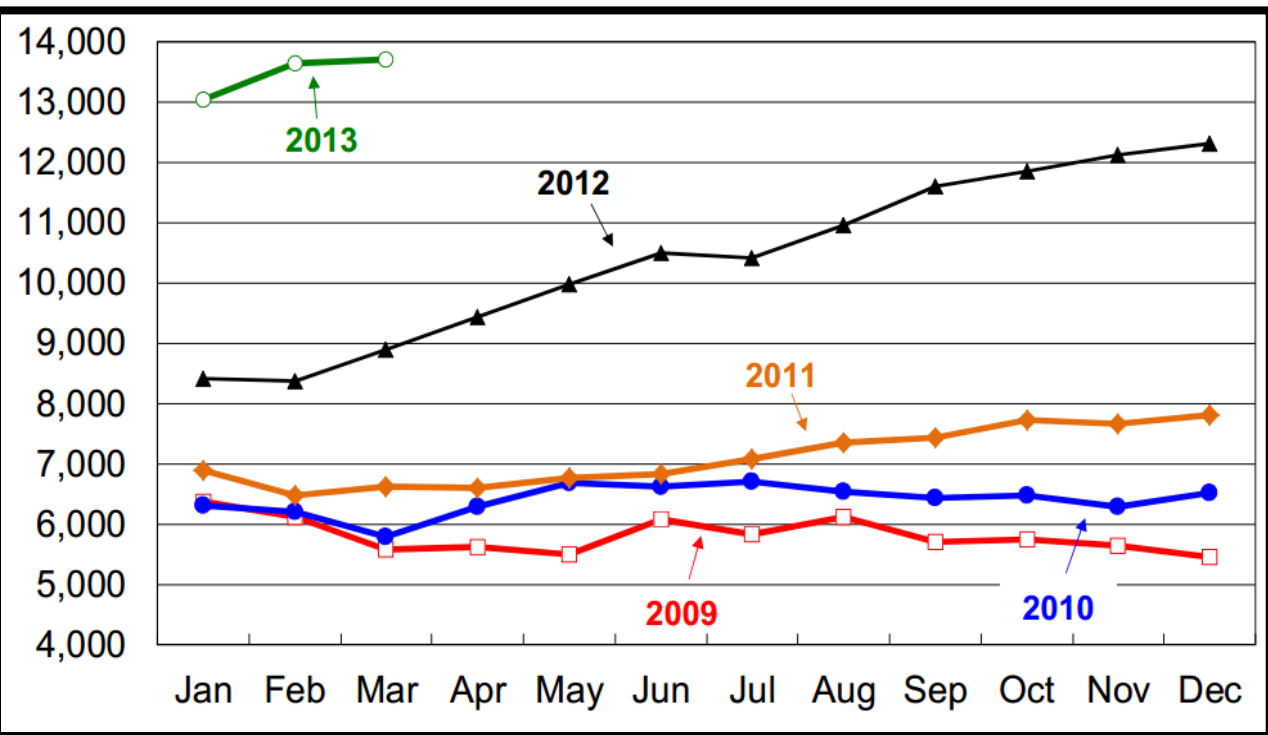
They are going to do a lot of this via rail.



Source: Phillips 66 Investor Presentation

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Average Weekly U.S. Rail Carloads of Petroleum and Petroleum Products

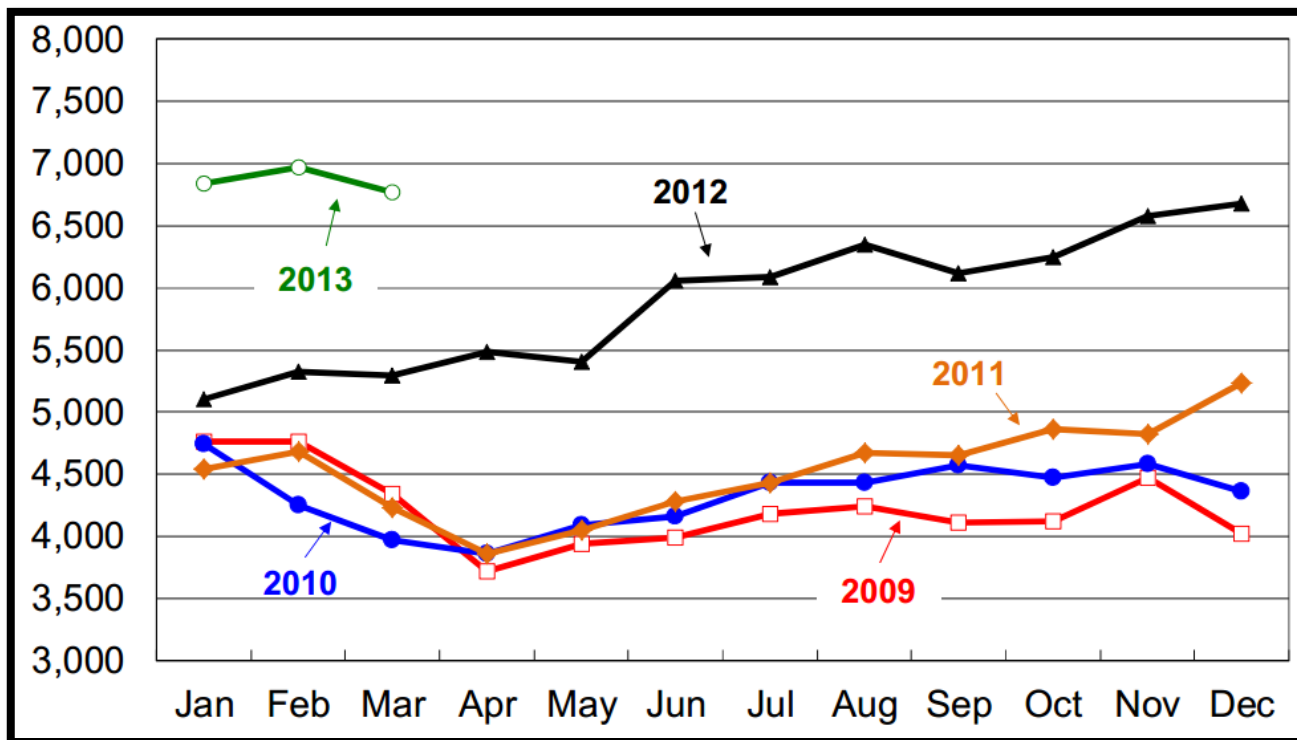


1.3 mbd of crude oil and product are moving by rail in the U.S. alone.

- Around 725,000 b/d crude moving by rail in the U.S.

Source: Association of American Railroads. Weekly Railroad Traffic
 crude petroleum and all products of petroleum refining (liquefied gases, asphalt, fuel oil, lubricating oil, jet fuel, etc.), exclude U.S. operations of CN and CP
Note: Data are weekly average originations for each month, are not seasonally adjusted; crude petroleum and all products of petroleum refining (liquefied gases, asphalt, fuel oil, lubricating oil, jet fuel, etc.); one carload holds 30,000 gallons (or 714.3 barrels).

Average Weekly Canadian Rail Carloads of Petroleum and Petroleum Products



643,000 b/d of crude oil and product are moving by rail in Canada

- Around 150,000 b/d crude moving from Canada, includes U.S. operations

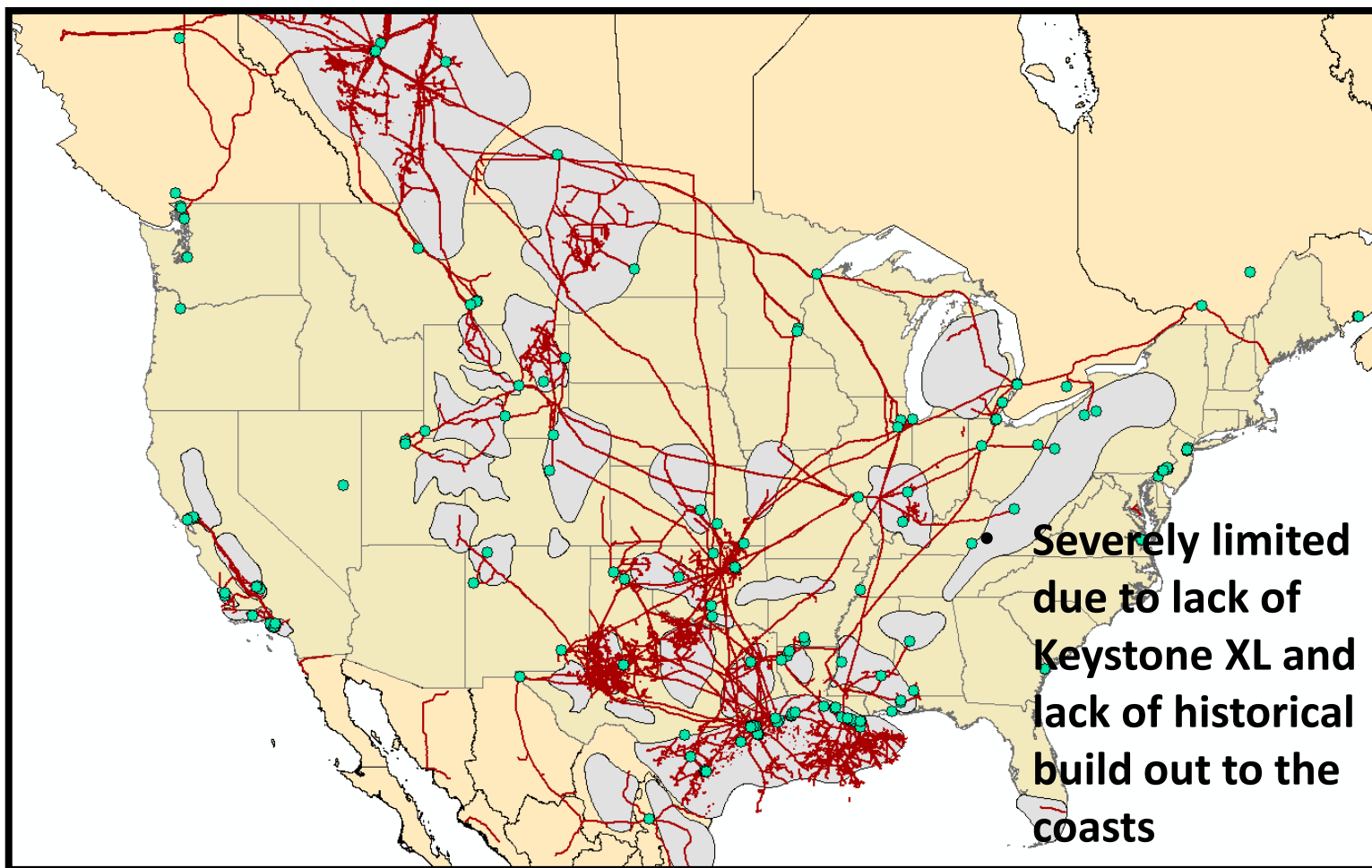
Source: Association of American Railroads. Weekly Railroad Traffic

crude petroleum and all products of petroleum refining (liquefied gases, asphalt, fuel oil, lubricating oil, jet fuel, etc.), includes CN and CP and their U.S. operations

Note: Data are weekly average originations for each month, are not seasonally adjusted; crude petroleum and all products of petroleum refining (liquefied gases, asphalt, fuel oil, lubricating oil, jet fuel, etc.); *one carload holds 30,000 gallons (or 714.3 barrels).*

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Crude Pipeline Infrastructure

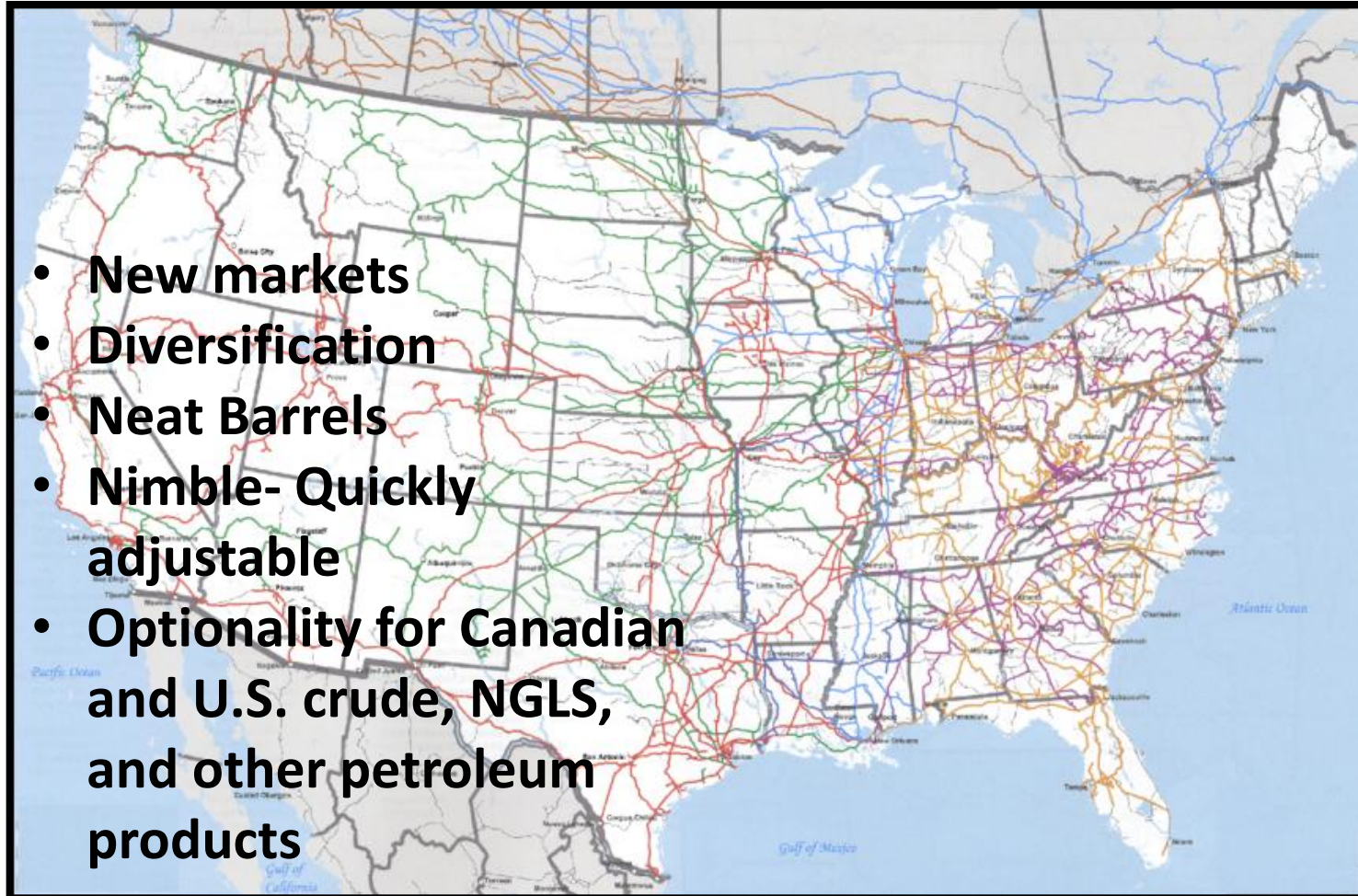


Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software

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Why it works

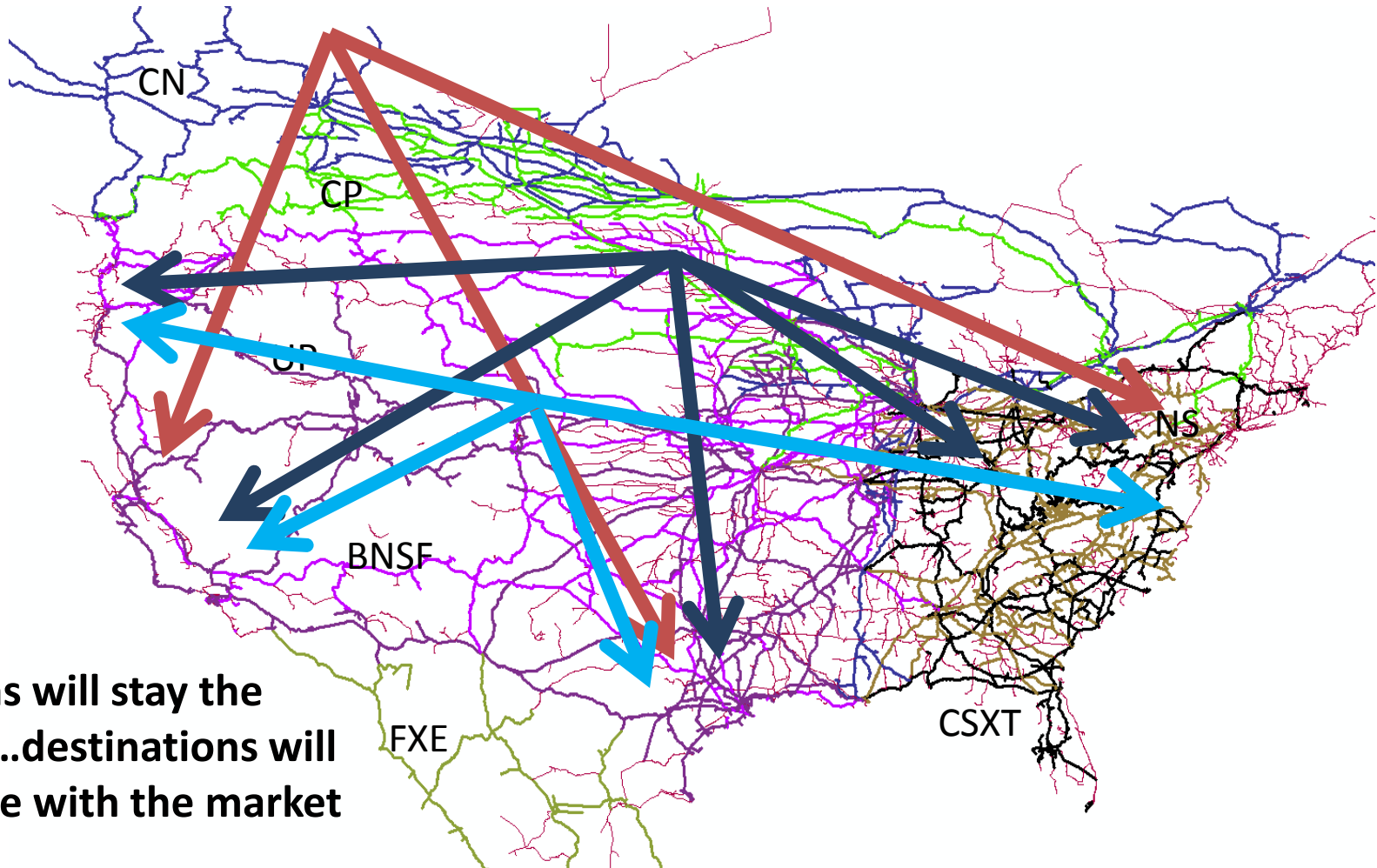
- **New markets**
- **Diversification**
- **Neat Barrels**
- **Nimble- Quickly adjustable**
- **Optionality for Canadian and U.S. crude, NGLS, and other petroleum products**



Source: Watco Companies LLC, Presentation Bakken Product Markets and Take-Away Denver Jan 31-Feb 1 2012

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Can Get to the Markets Pipelines Can't and WON'T

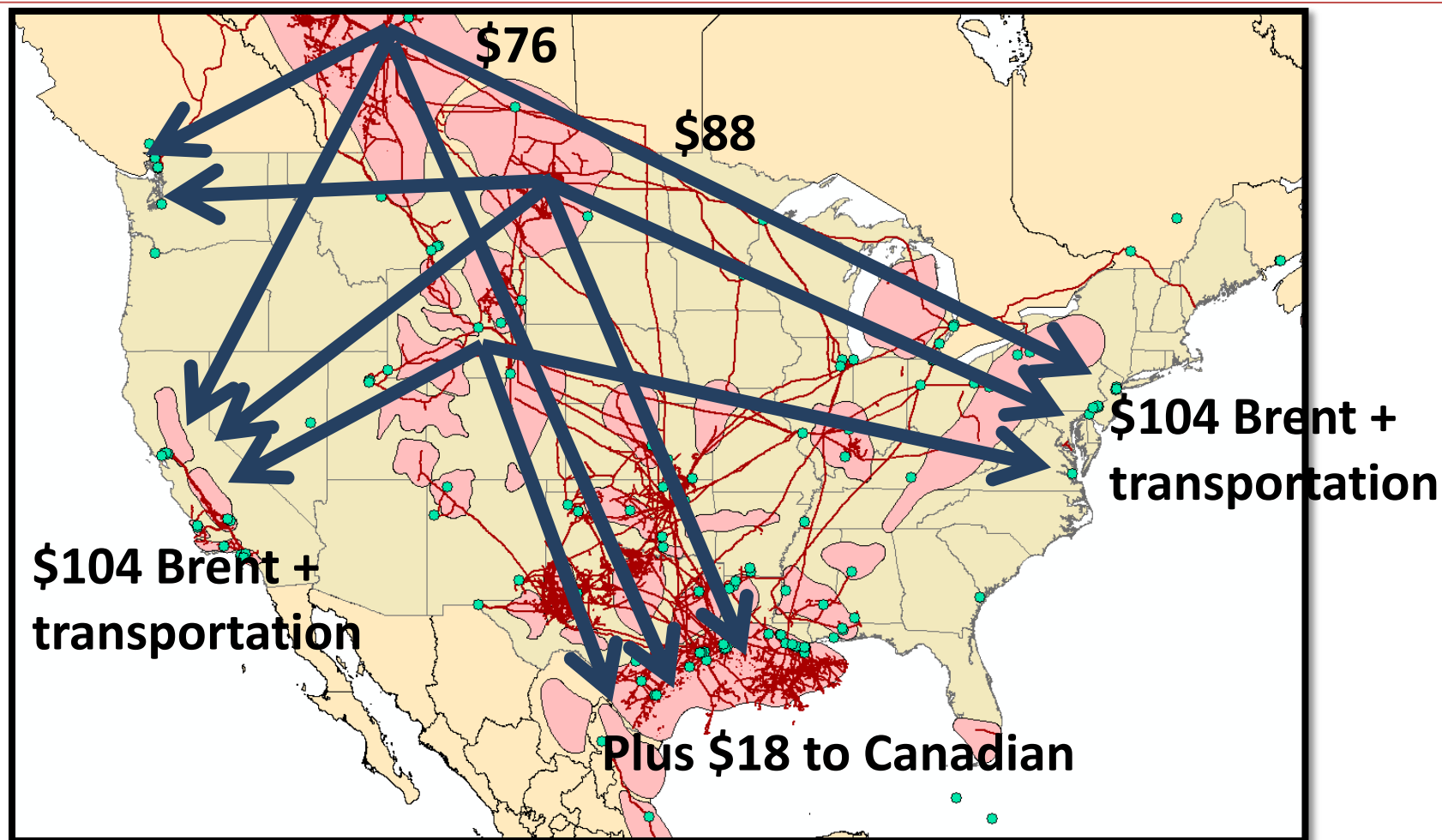


Origins will stay the same...destinations will change with the market

Source: EPRINC map using ArcGis

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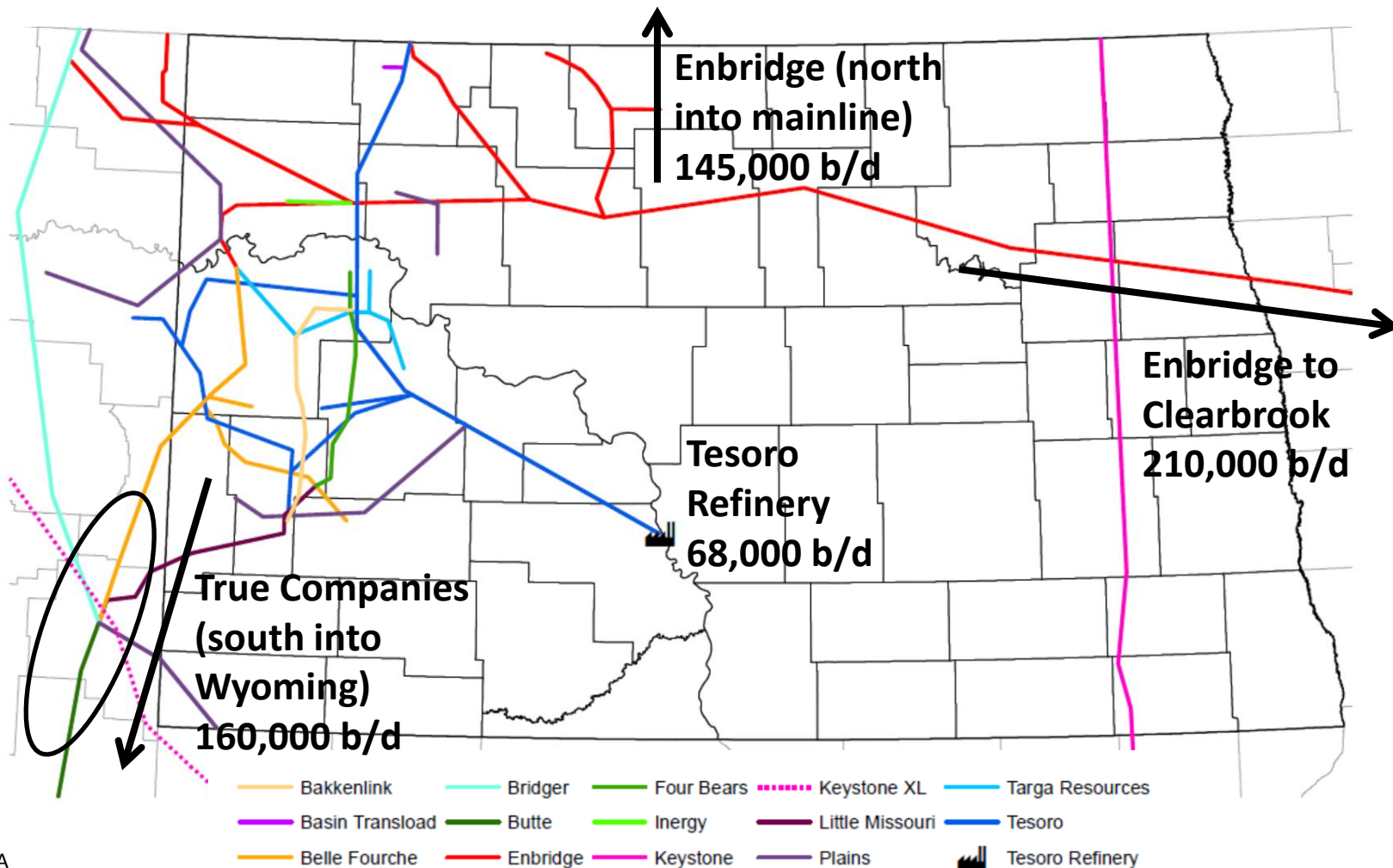
But how much?



Source: Bloomberg

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Spare Capacity in North Dakota

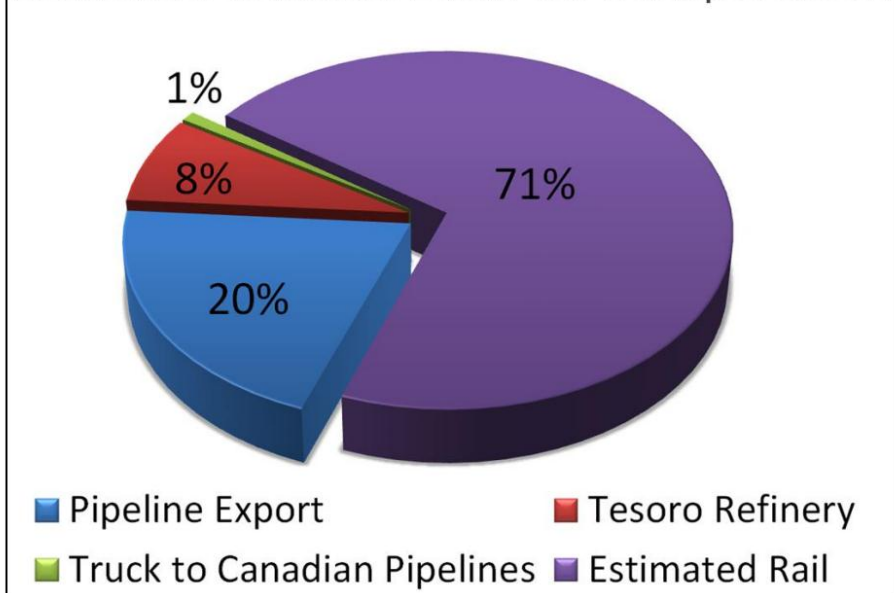


Source: NDPA

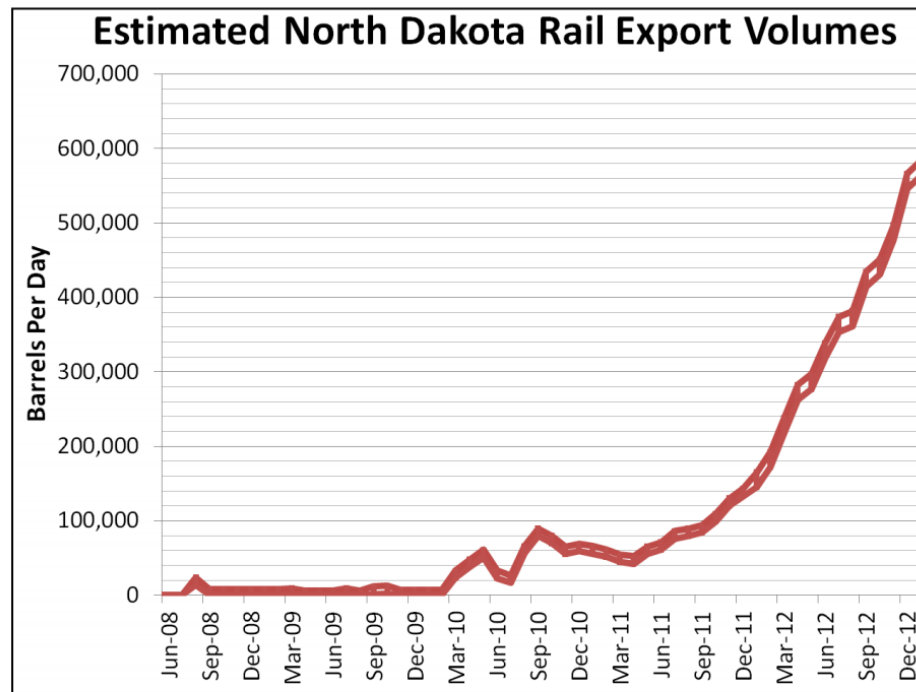
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Rail Volumes Out of North Dakota

Estimated Williston Basin Oil Transportation



February 2013 Estimates



High and Low Estimate - February 2013

Source: NDPA

Issues and Regulations

With more and more crude moving via rail, the chances for spills have increased and are gaining more attention.

Permits also seem to be a concern in some places.



Rail Ruptures

As energy companies increasingly ship crude oil by rail, incidents involving oil spills are on the rise. Most of the recent leaks have been relatively small, according to federal data through 2012.

NUMBER OF SPILLS	1	1	1	3	1	1	8	1	9	34	69
AMOUNT SPILLED, in barrels	Less than one	0	Less than one	36	2	Less than one	1,931	Less than one	117	94	89
AMOUNT TRANSPORTED, in millions of barrels*	8.6M	8.8M	7.1M	4.3M	3.4M	4.2M	6.8M	7.7M	21.1M	47M	167M
YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012

Note: Each barrel holds 42 gallons. *Number of barrels is based on carload data multiplied by 30,000

Sources: Department of Transportation Pipeline and Hazardous Materials Safety Administration; Association of American Railroads

The Wall Street Journal

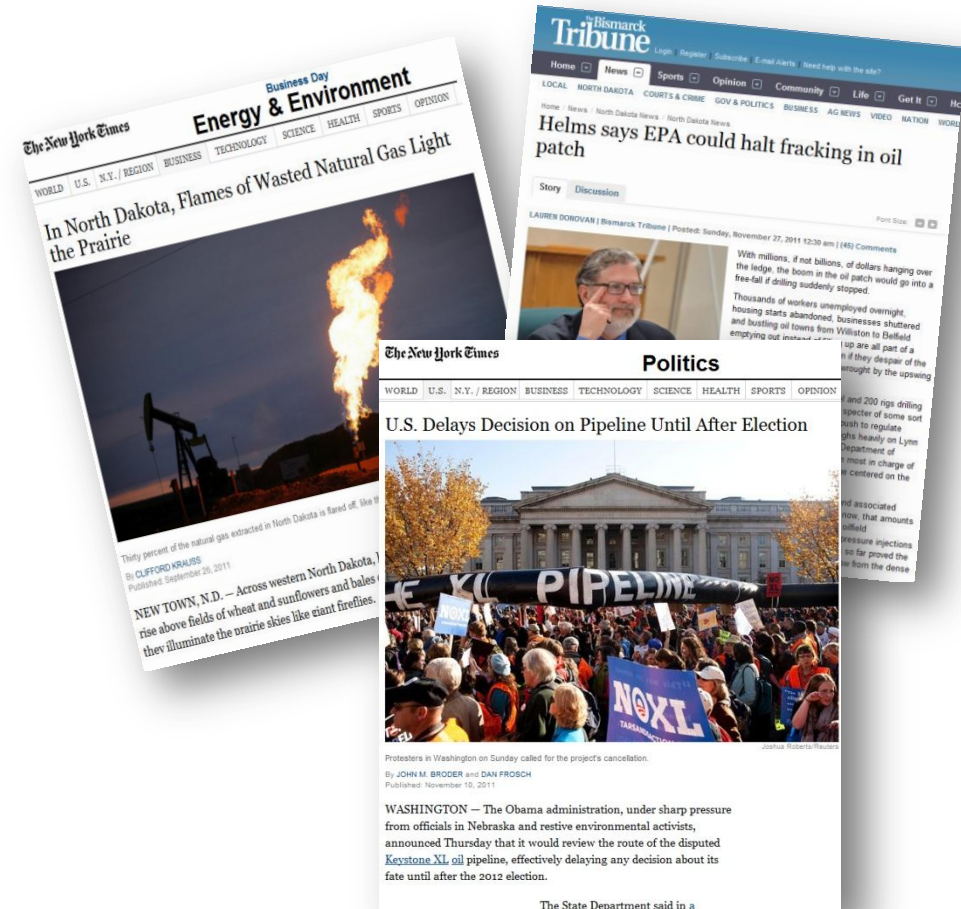
Scott Marquardt/The Parkers Prairie Independent via WSJ March 28th, 2013 "A 94-car Canadian Pacific Railway train partially derailed in Parkers Prairie, Minn., on Wednesday, spilling as much as 714 barrels of crude, according to Minnesota officials. Oil is visible on the ground in the lower left."

By [TOM FOWLER](#) WSJ MARCH 28, 2013 "OIL SPILLS MOUNT ON TRACKS"

— emitte lucem et veritatem —

Potential Issues, Hurdles, and Regulatory Concerns

- Oil prices
- Water Usage!
- Oil spills (rail and pipeline)
- Environmental Concerns
- Regs on Federal Land-Fracking
- Infrastructure Delays-
PERMITTING
- Lack of prudent policy: failing to connect what is happening on the ground to what is understood in Washington



Conclusions

- This is a petroleum renaissance. Since 2008 the U.S. and Canada have added nearly 3 mbd of crude to global production, helping offset issues and Libya and the Middle East. The U.S. is the largest producer of natural gas in the world and quickly becoming one of the lowest cost energy producers in the world.
- Pipelines are being built, but right now their still exists tightness in the system and an increasing need for 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 (as well as PADD V)...only so much light sweet can be sent to Cushing and down into Gulf.
- Rail in the long-term...it is going to be there, but the question is “how much”?...pipelines?
- Refineries are going to play a vital role in this renaissance as they adapt to high volumes of light sweet crude.