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Keystone XL Pipeline
Critical Infrastructure for the North American Petroleum Renaissance

Transportation Review Board
P12-6118

Panel on:
Energy Security and Unconventional and Alternative Liquid Fuels: Canadian Oil Sands, U.S. Shale Oil Formations and Compressed Natural Gas, and Biofuels--What Does This Mean for the Future?

January 23, 2011
Washington, DC

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Energy Policy Research Foundation, Inc.
Washington, DC

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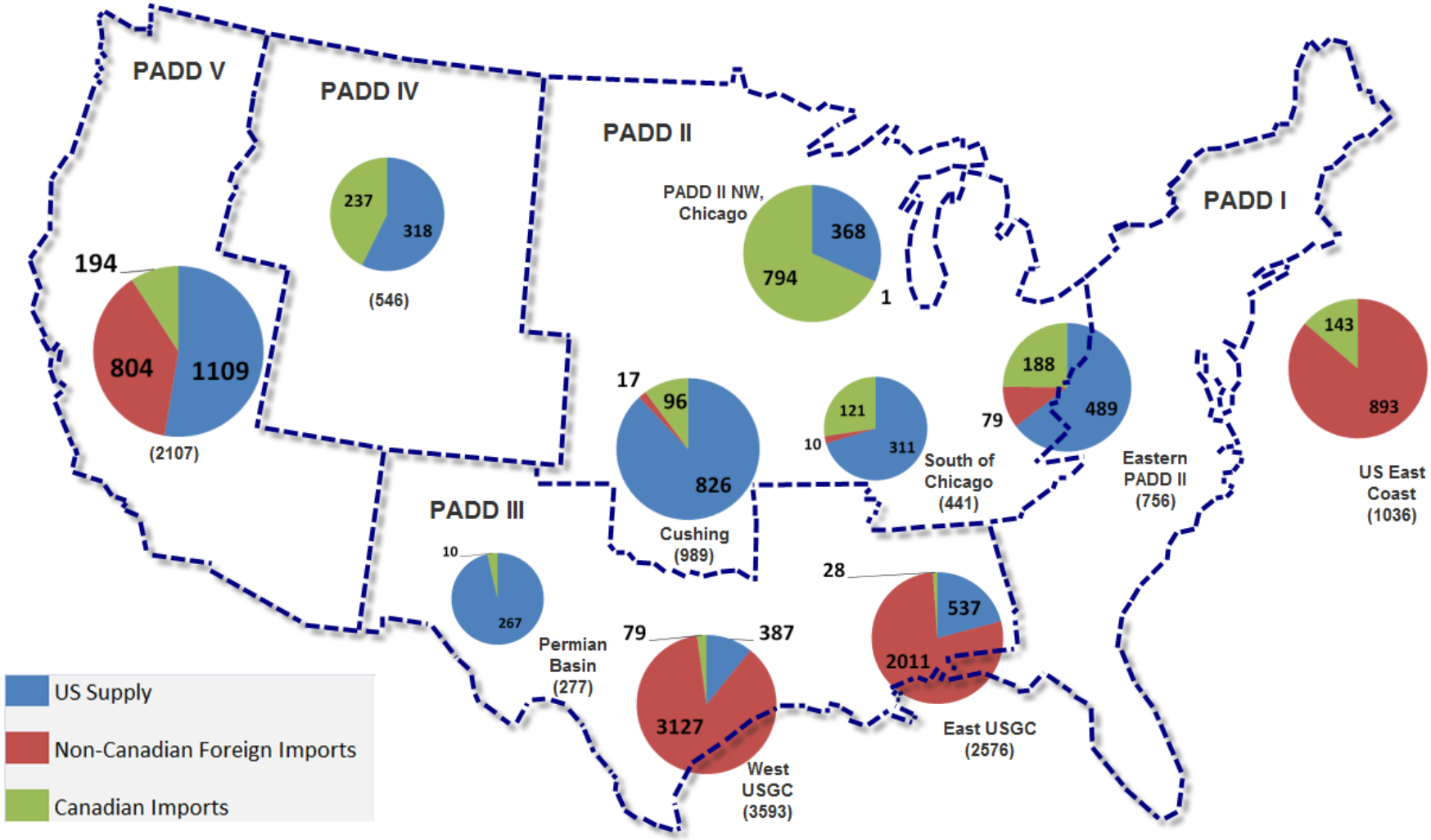
The Route

Canadian Imports and Potential Markets



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

Crude Disposition by Region 2010 (MB/D)

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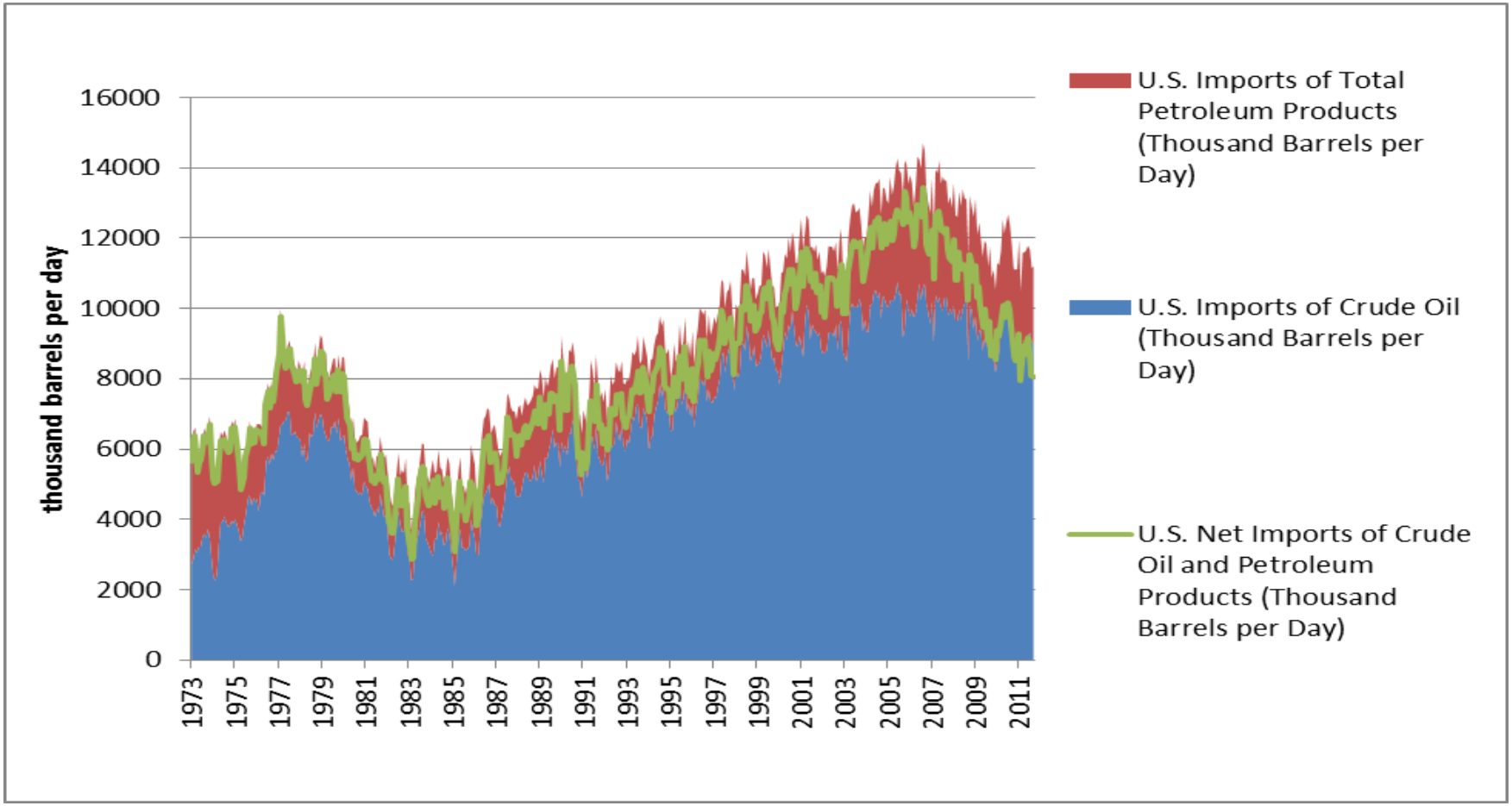
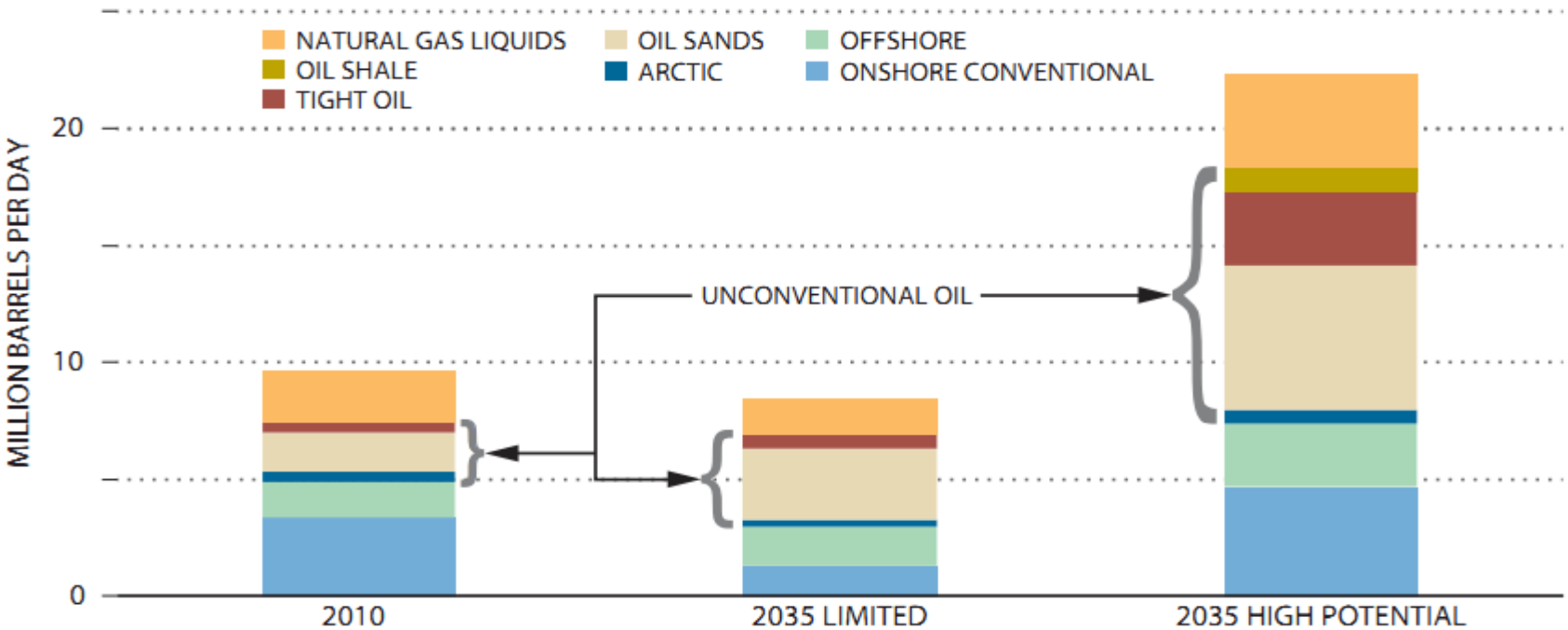
US Petroleum Imports and Exports



Source: EIA, EPRINC Calculations

NPC Findings
Future Oil Production

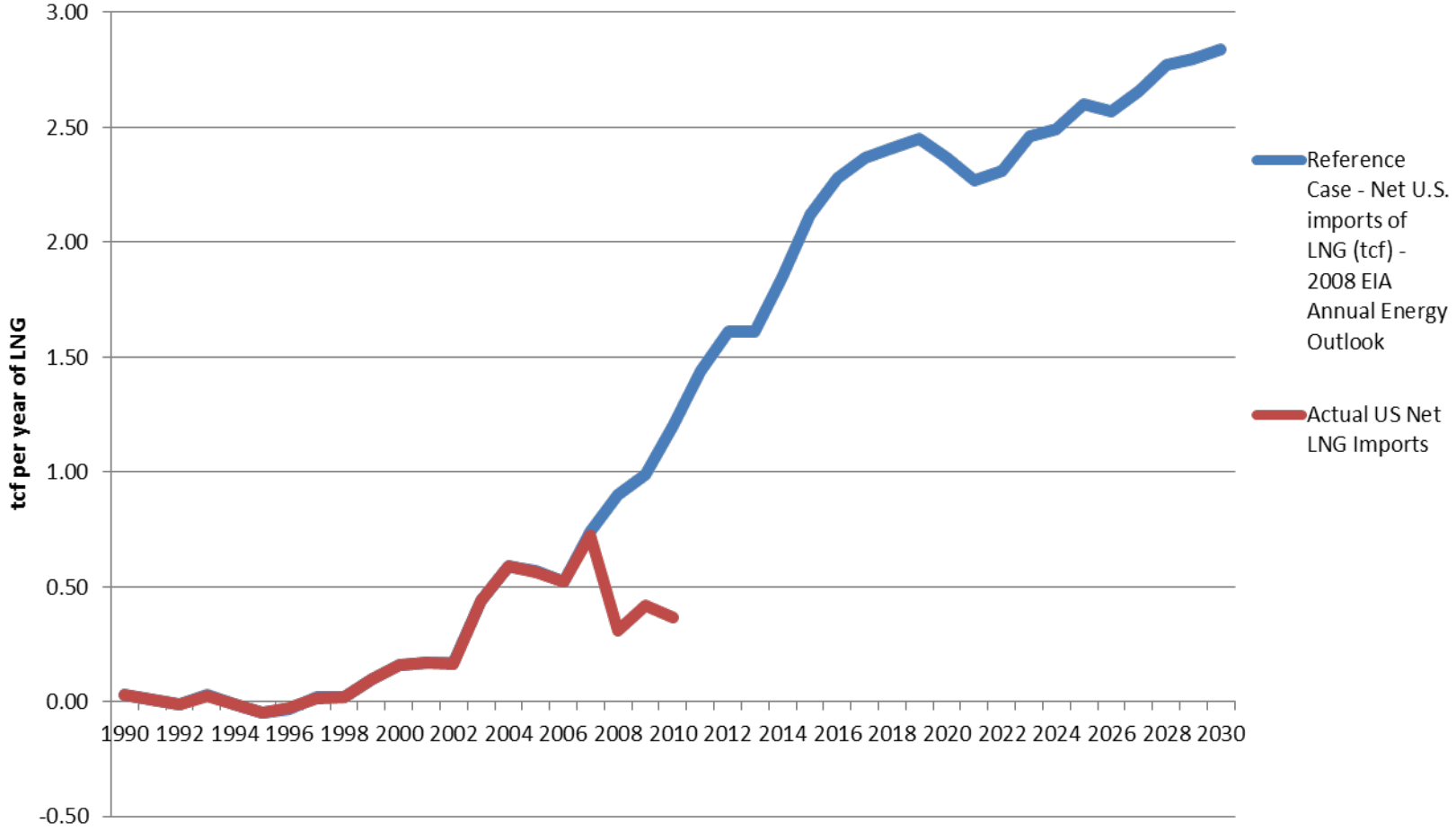


Note: The oil supply bars for 2035 represent the range of potential supply from each of the individual supply sources and types considered in this study. The specific factors that may constrain or enable development and production can be different for each supply type, but include such factors as whether 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.

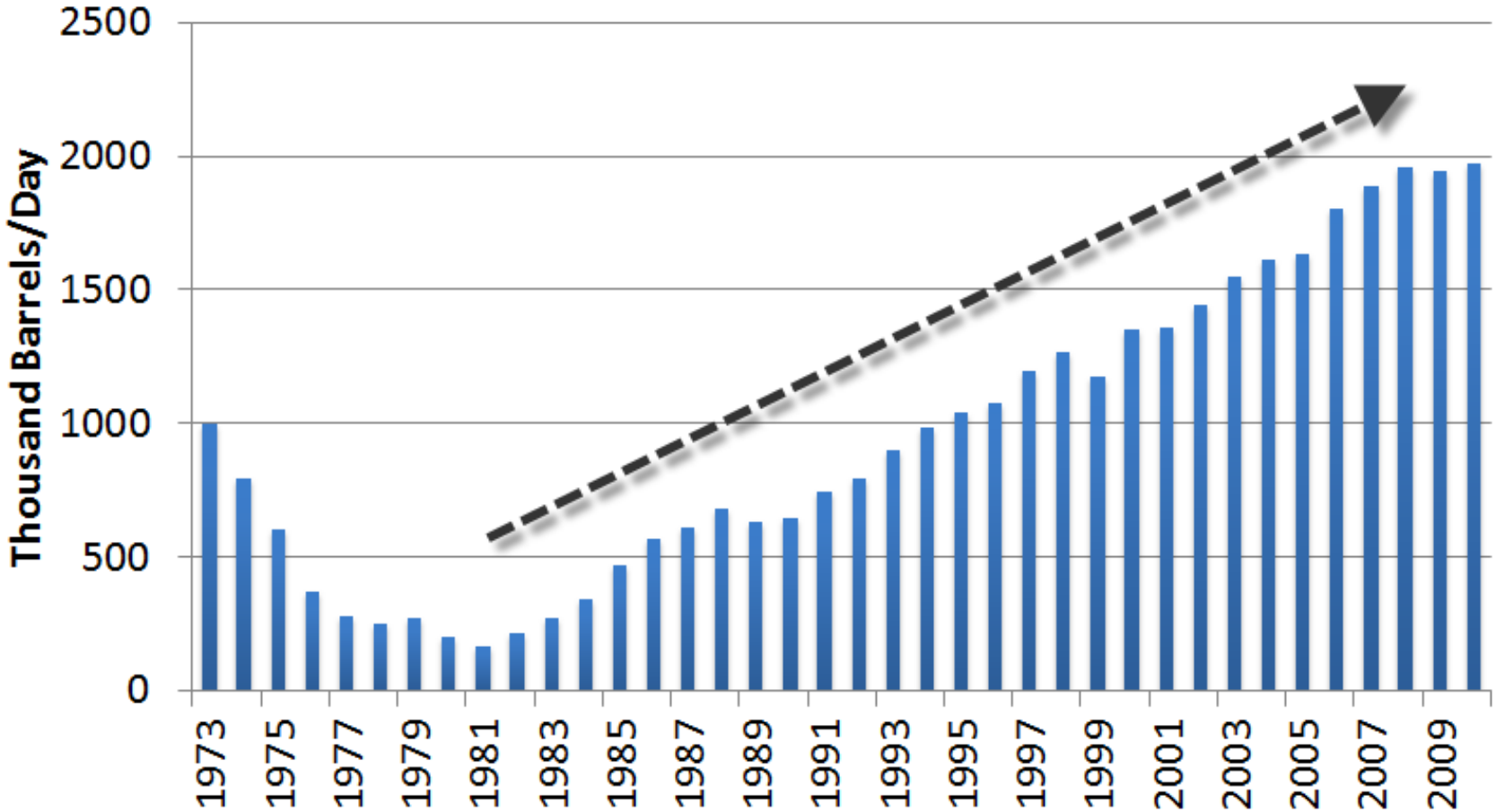
Projected Imports of LNG vs. Actual

(or why forecasters should be humble)



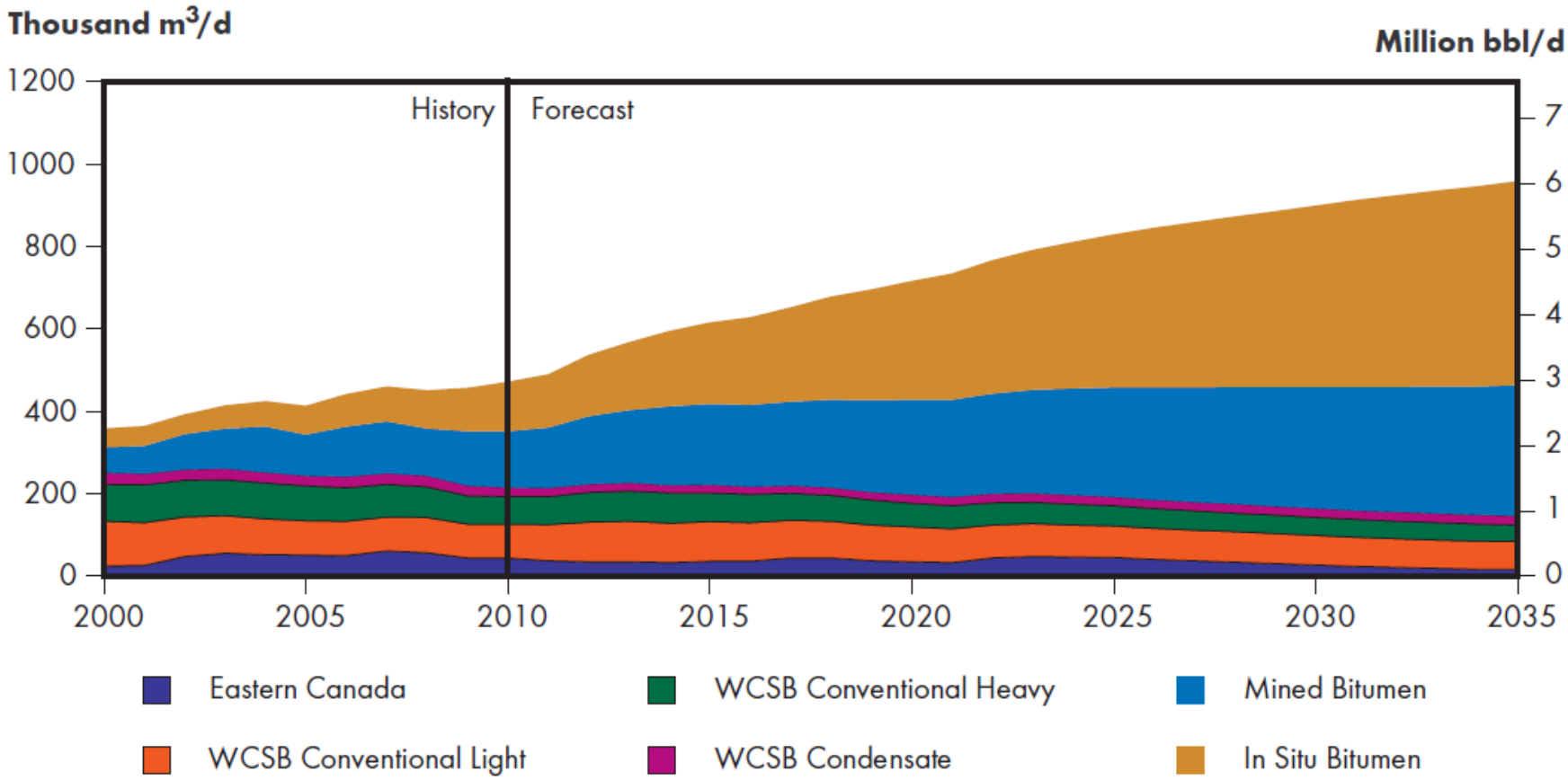
Source : EIA Data form the 2008 *Annual Energy Outlook*

Canadian Imports



Source: EIA

Total Canadian Oil Production (NEB Reference Case)



Source: "Canada's Energy Future: Energy Supply and Demand Projections to 2035." Nov 2011. NEB

Cost of Oil Sands Production

Estimated Initial Capital Expenditure (CAPEX) and Threshold[a] Prices for New Oil Sands Projects

	CAPEX ($Cdn / bbl of capacity, Cdn$2010)	**Economic Threshold** (WTI US$ equivalent / bbl, US$2010)
Mining, Extraction and Upgrading	$85,000-$105,000	$85-$95
Mining and Extraction Only (No upgrading)	$60,000-$75,000	$65-$75
Steam-assisted Gravity Drainage (SAGD)/Cyclic Steam Stimulation (CSS)	$25,000-$40,000	$50-$60

(a) Includes a realistic after-tax rate of return, commonly in the order of 10 to 15%.

Source: "Canada's Energy Future: Energy Supply and Demand Projections to 2035." Nov 2011. NEB

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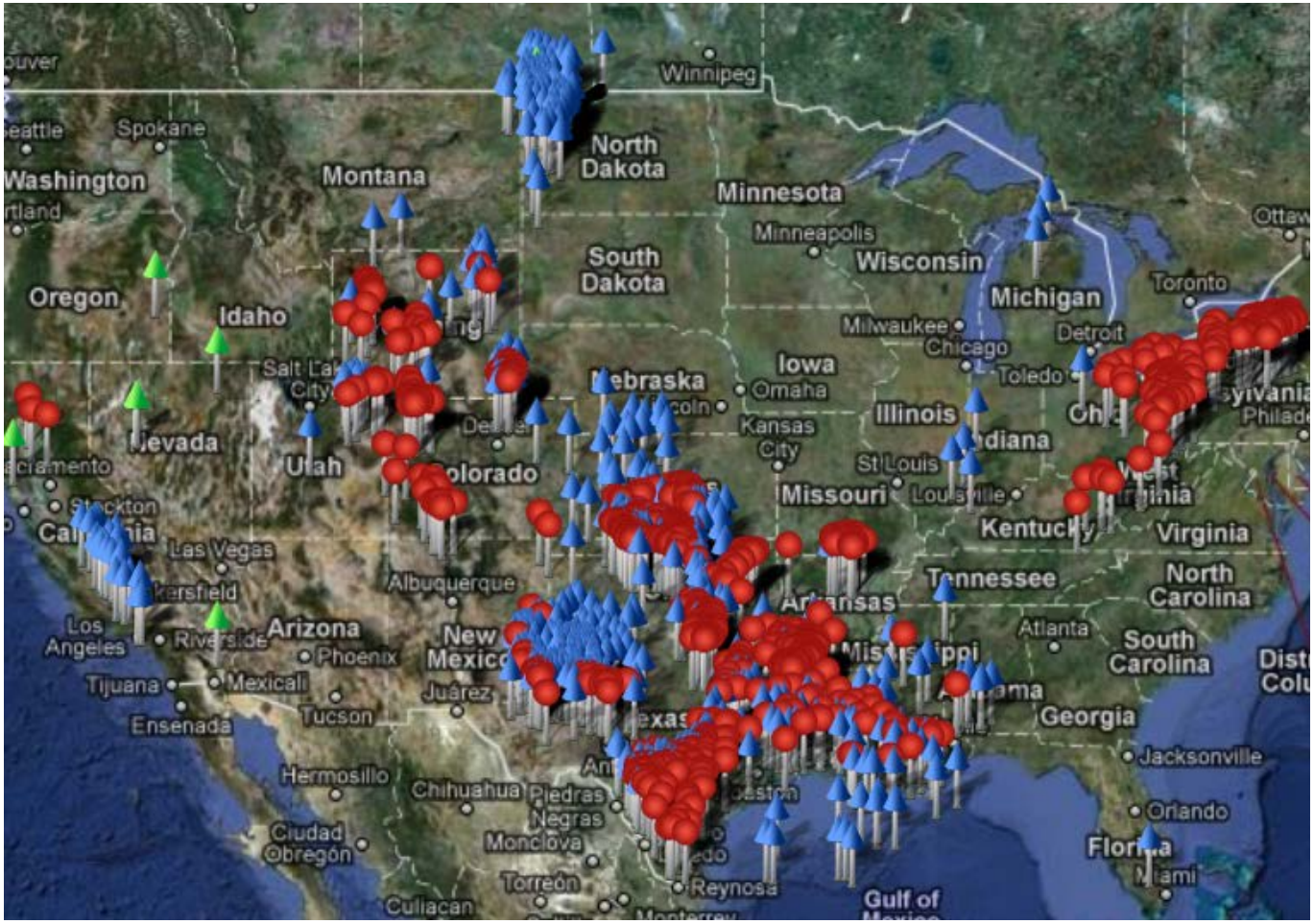
Building Blocks of North American Unconventional Oil Production*

- **Williston Basin (Bakken, et al in North Dakota)**
- **Eagle Ford (Texas Liquids)**
- **Utica (Wet and Dry and a New Play)**
- **Permian (Gift that Keeps on Giving)**

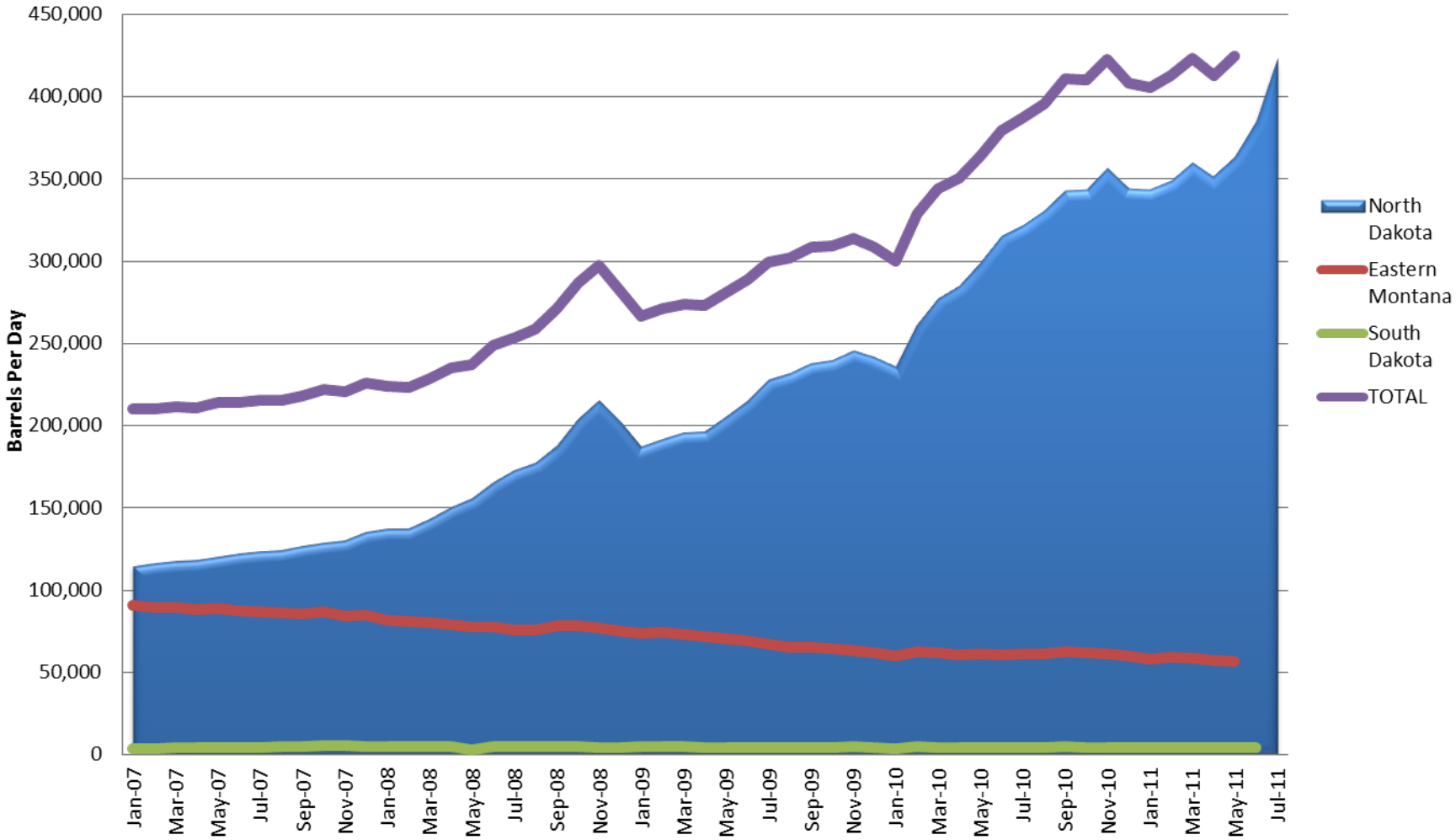
*** There's more!!!!**

Systemic Impacts and Infrastructure Needs: Growth in Other Shale Plays



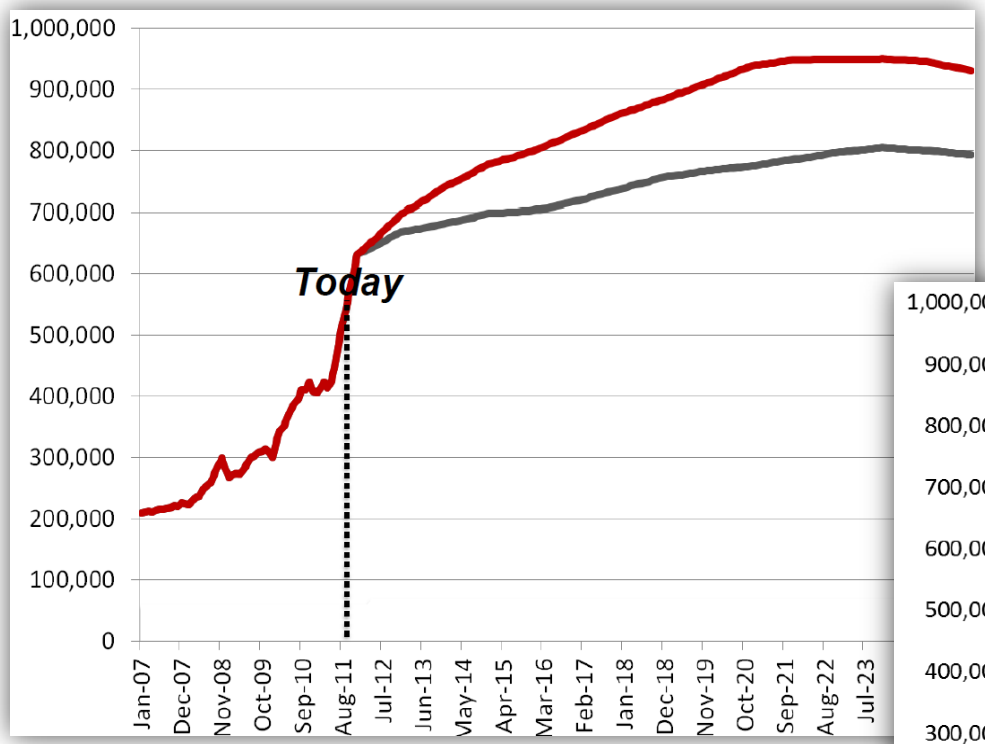
Source: Baker Hughes Interactive Rig Count July 7th 2011

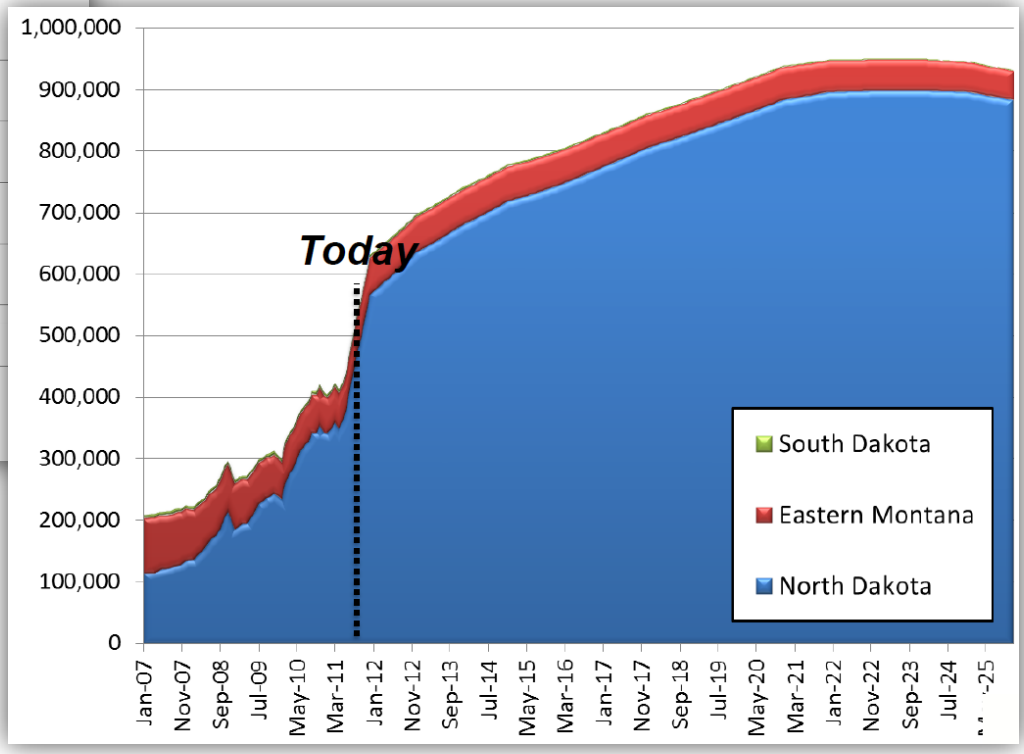
Williston Basin Production



Source: North Dakota Pipeline Authority

NDPA Williston Basin Production Forecasts B/D





Source: North Dakota Pipeline Authority

Pipeline, Rail, Refinery, and Truck

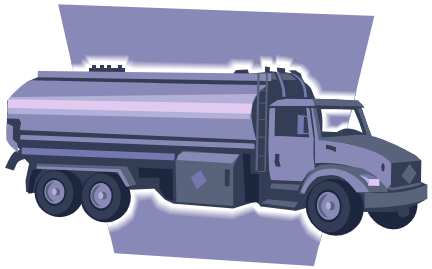
Current Estimate Williston Basin (ND, Eastern Montana, SD)

Pipeline: 355,000 b/d

Refinery: 58,000 b/d

Rail: 95,000 b/d

Truck: 25,000 b/d



Source: North Dakota Pipeline Authority

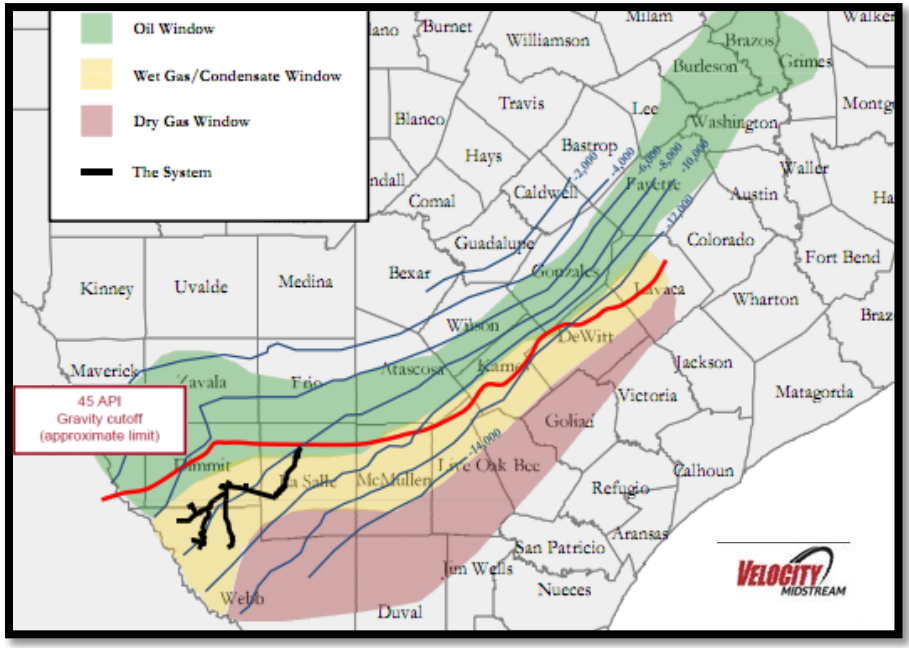
Eagle Ford --The Basics

- The Eagle Ford stretches across south Texas more than 180 miles. It is a shale oil, condensate/NGL, and dry gas play that increases in depth and maturity as you move south and slightly to the west.

- Estimates of recoverable liquids range from three to seven billion barrels

- The play produces low sulfur (low in oil window and only minimal in condensate window) high API gravity oil and condensate ranging from 45 degrees to 65 degrees and increases in gravity as you move south from oil to gas

- Current production is nearly 200,000 boe/d and set to continue in the coming months and years, especially as the necessary take-away capacity comes in mid to late 2012



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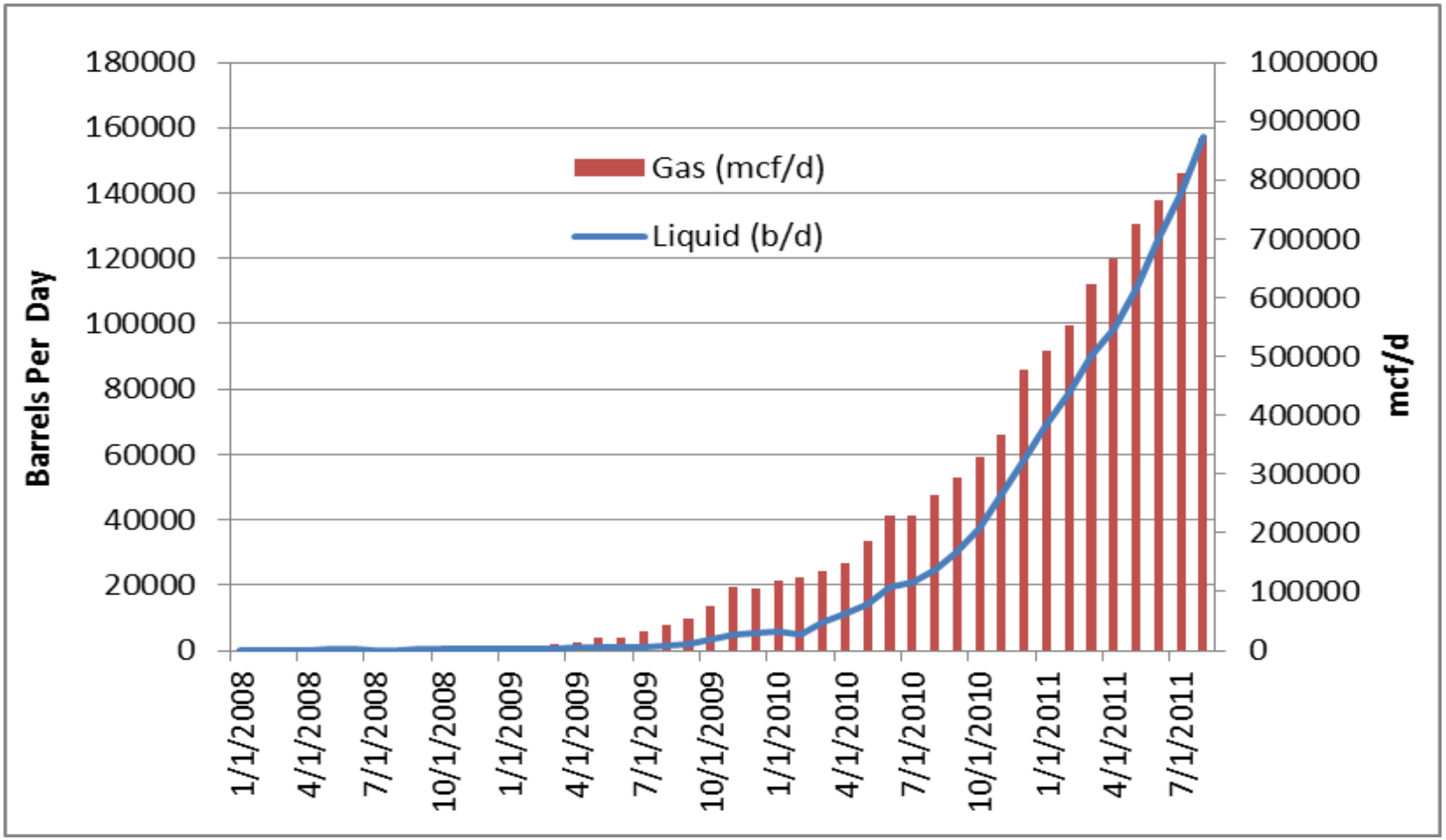
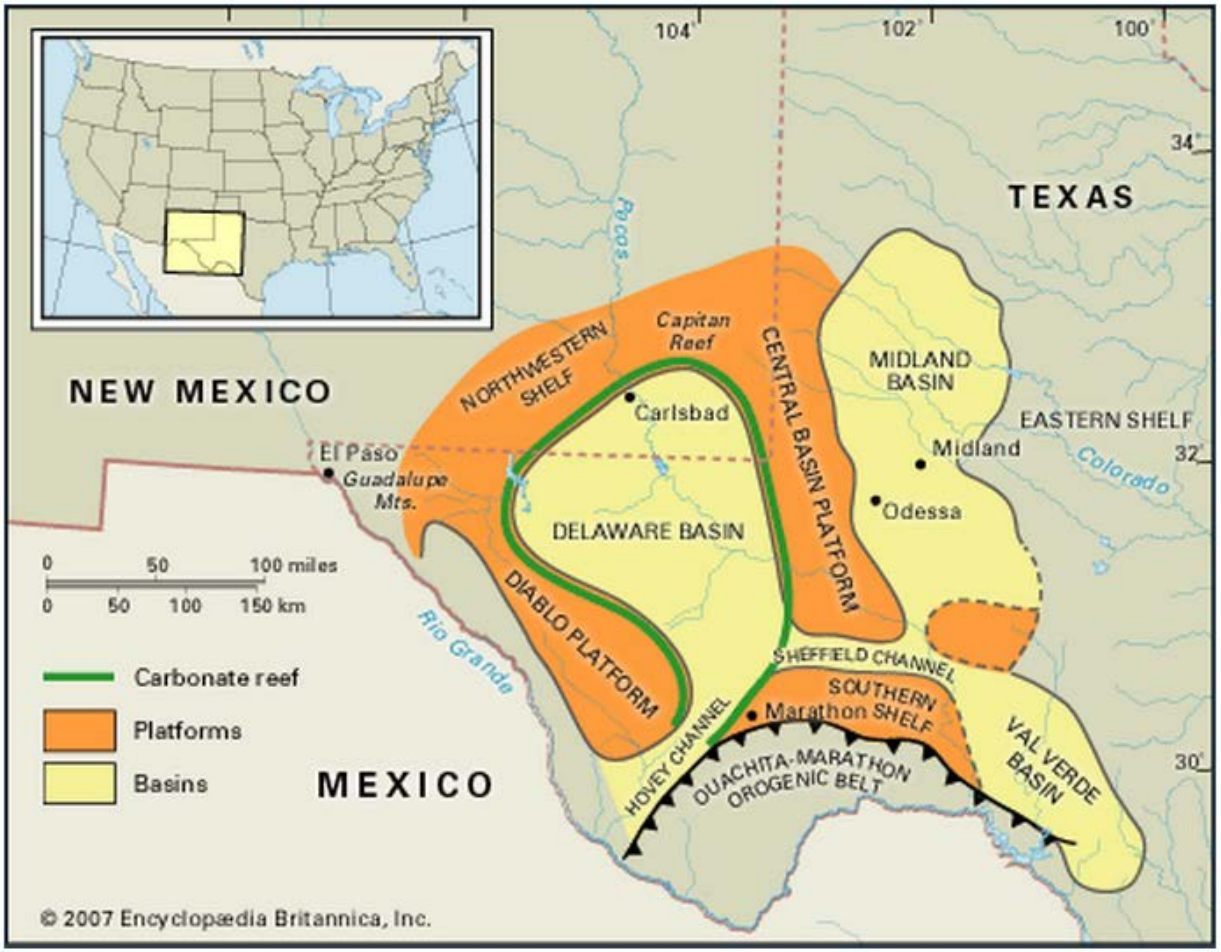
Eagle Ford Production



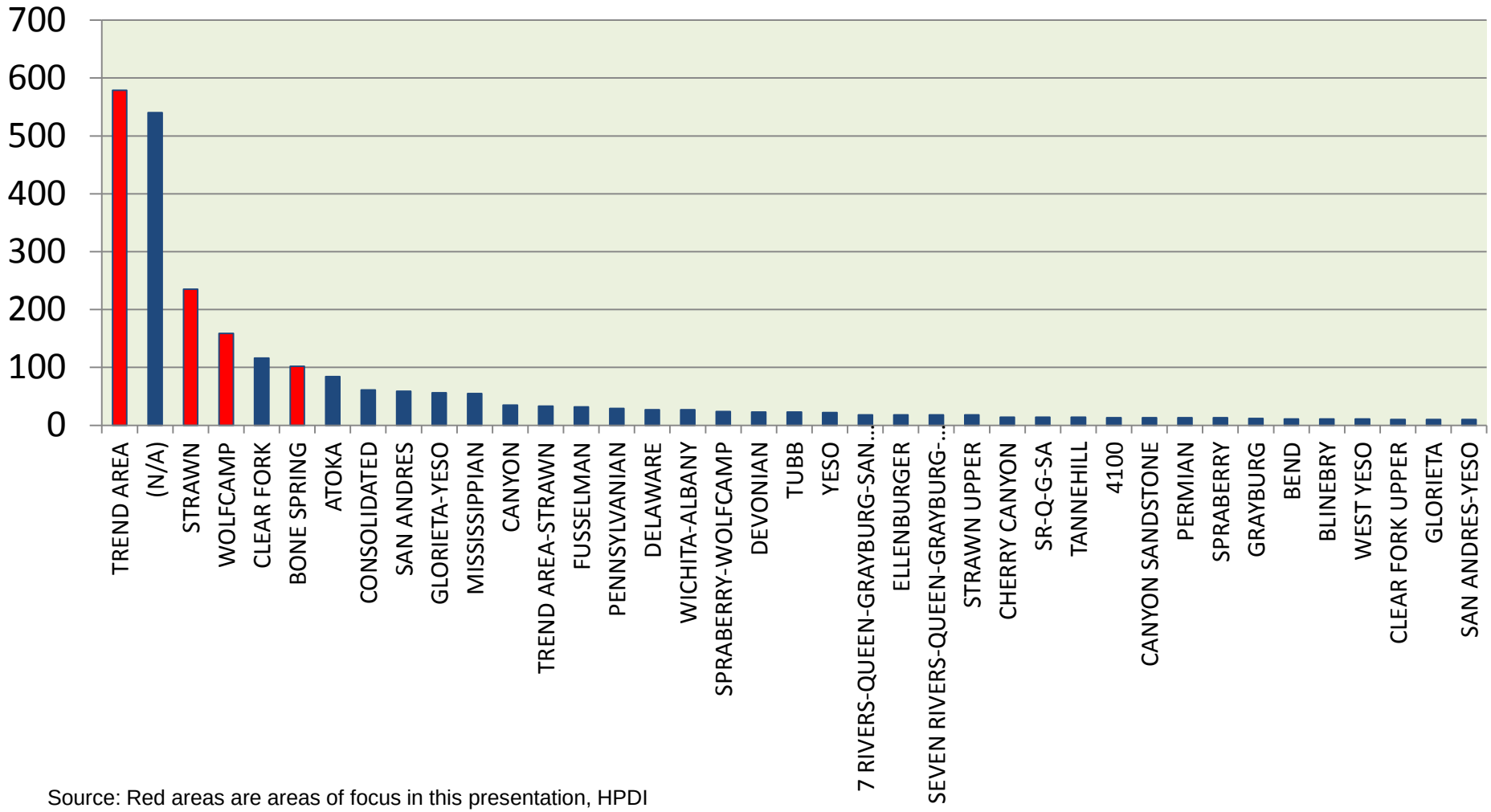
Source: HPDI

Breakdown of the Permian Basin Province



Source: *Permian Basin*. Map. *Encyclopædia Britannica Online*. Web. 17 Jan. 2012. <http://www.britannica.com/EBchecked/media/94328/Map-of-the-basins-reefs-and-platforms-that-make-up>.

Permian Basin Permits in Past 90 days by Reservoir



Source: Red areas are areas of focus in this presentation, HPDI

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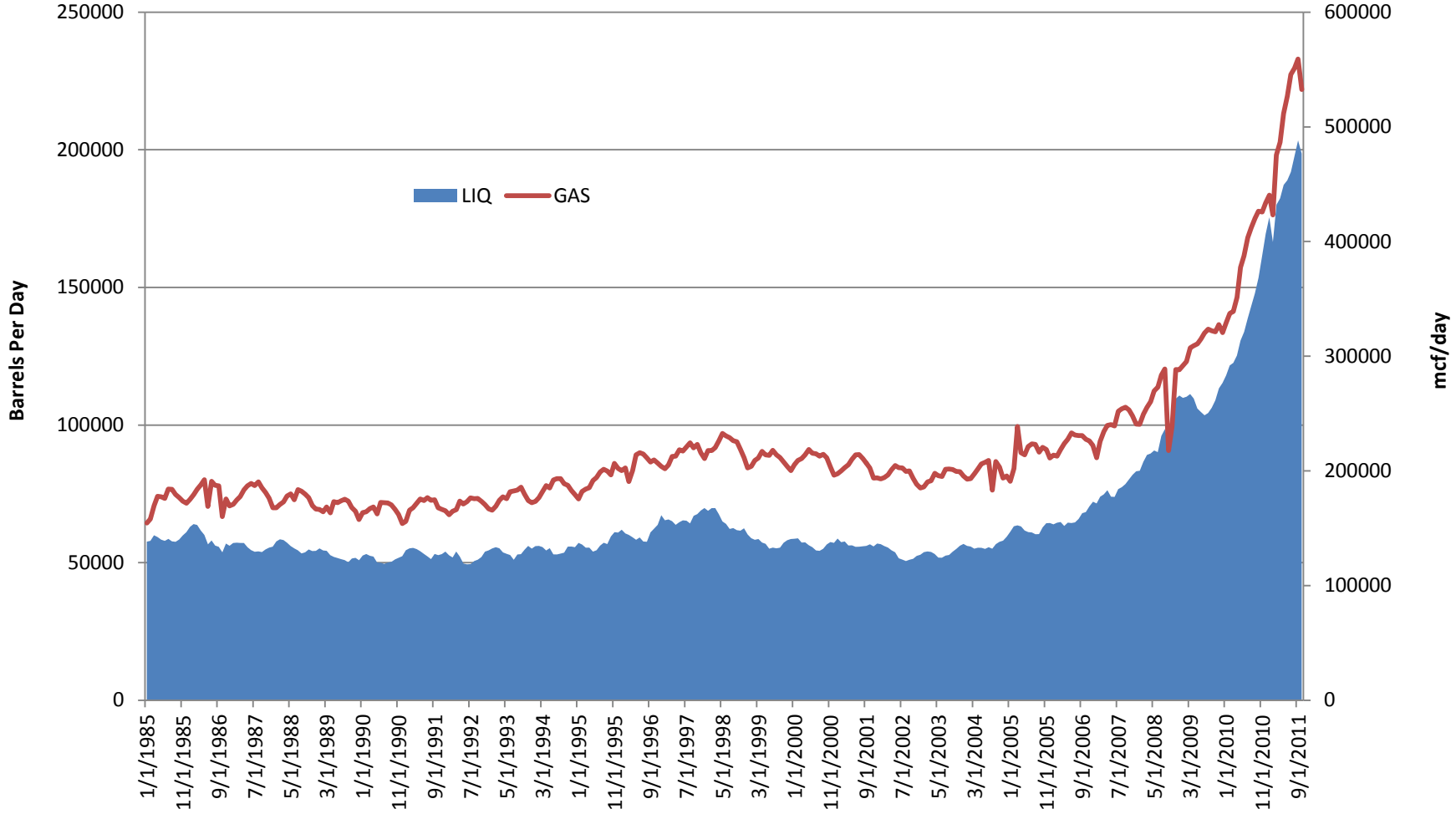
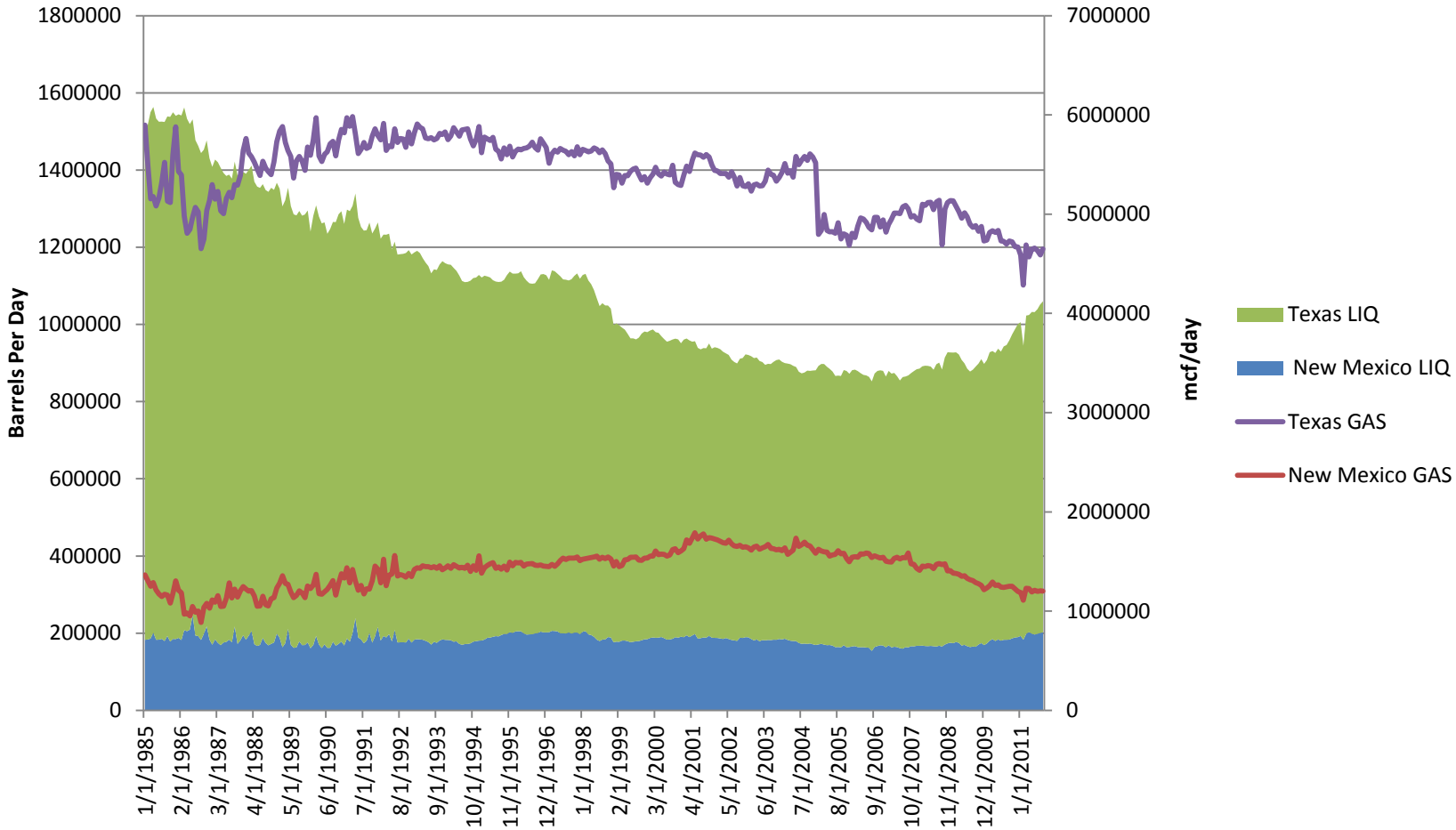
Trend Area Daily Average Production

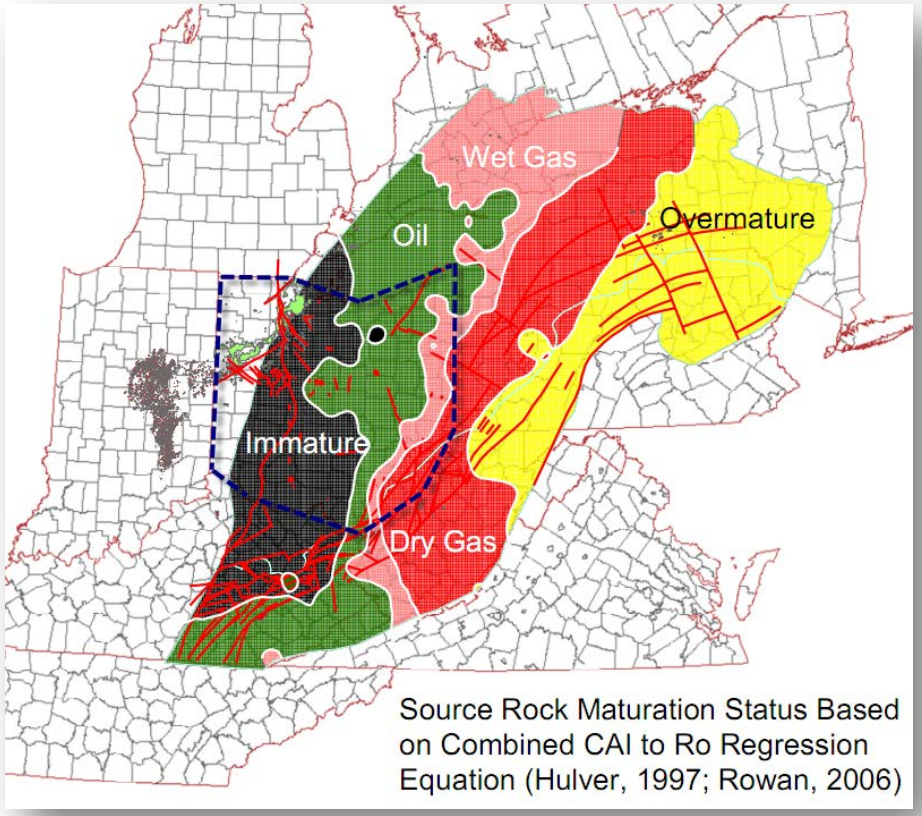


Permian Basin Oil and Gas Production

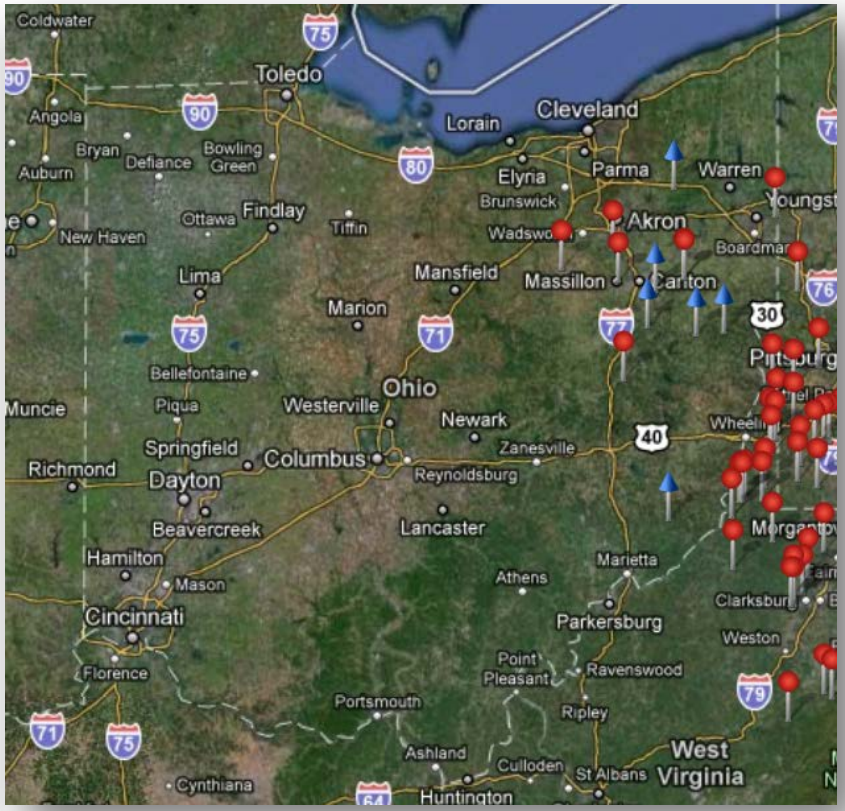


Source: HPDI

Utica Oil and Gas Potential in Ohio

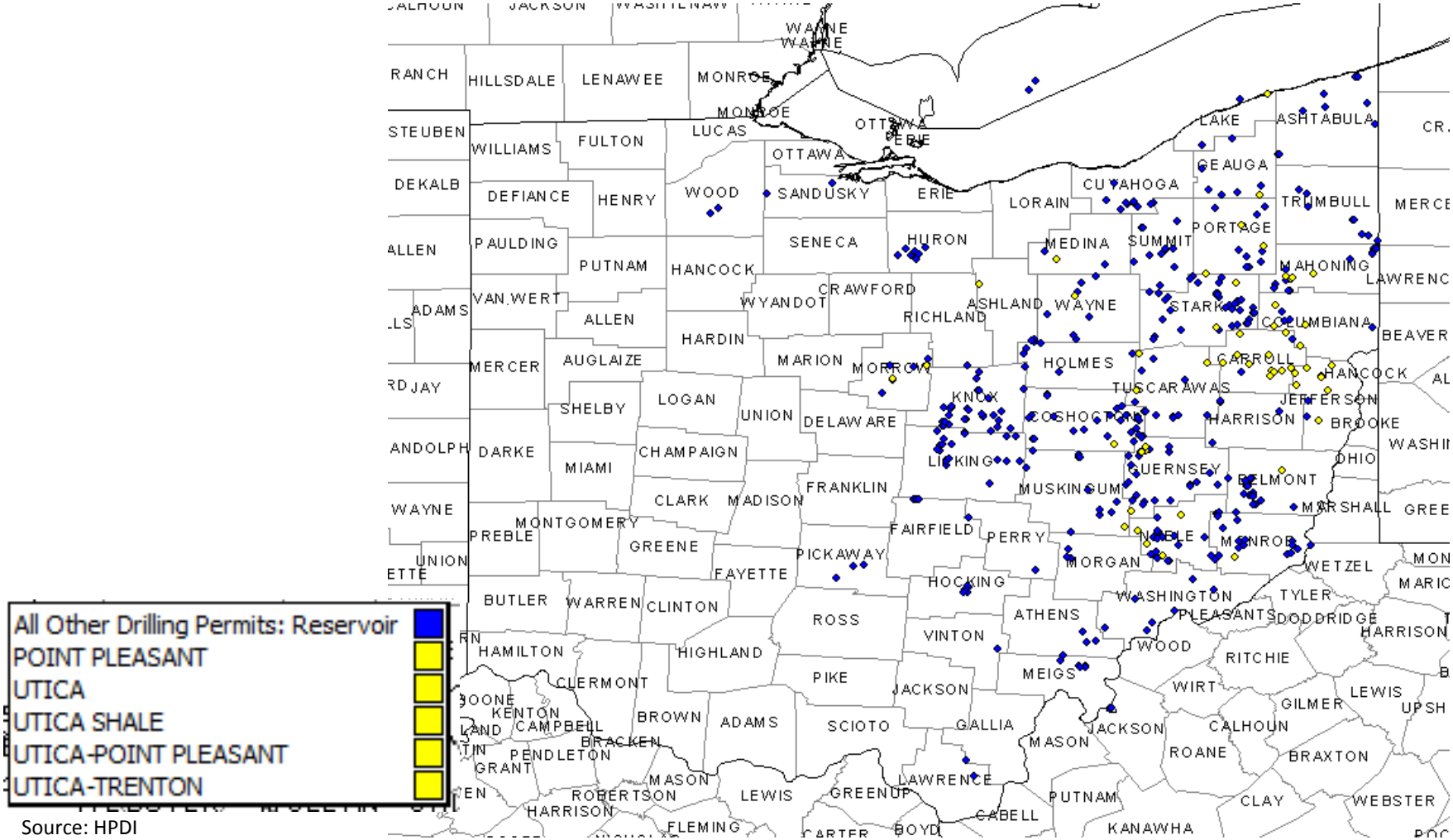


Source: Ohio Government Department of Natural Resources
http://www.dnr.state.oh.us/geosurvey/tabid/23014/Default.aspx



Source: Baker Hughes Interactive Rig Count, Ipad, Dec 2, 2011

Ohio Drilling Permits



Source: HPDI

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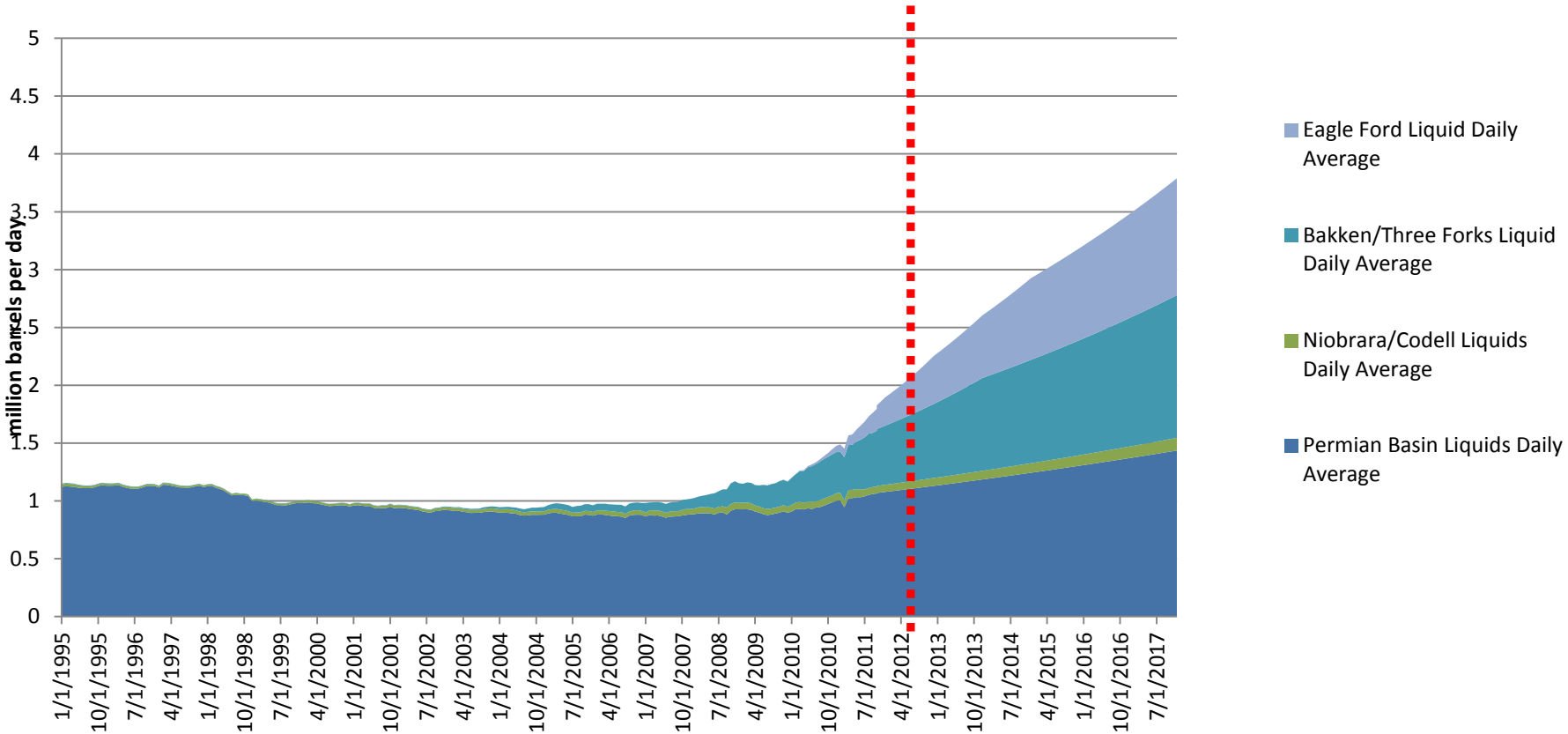
Near Term Outlook --Unconventionals



Building Out the Infrastructure

- **2011 to 2016 , 3 million barrels/day (mmb/d) increase (36%) in U.S. and Canadian oil production likely.**

- **Of this combined increase in U.S. and Canadian oil output, 900,000 bbl/d will come from Canada and be shipped to the U.S. Volumes likely to outpace demand growth.**

- **U.S. oil imports (excluding imports from Canada) are projected to drop by 41% bringing U.S/Canadian imports to roughly 4 mmb/d in 2016.**

- **Infrastrucuture likely to require over 70 pipeline expansions, 25 rail projects and seven refinery expansions.**

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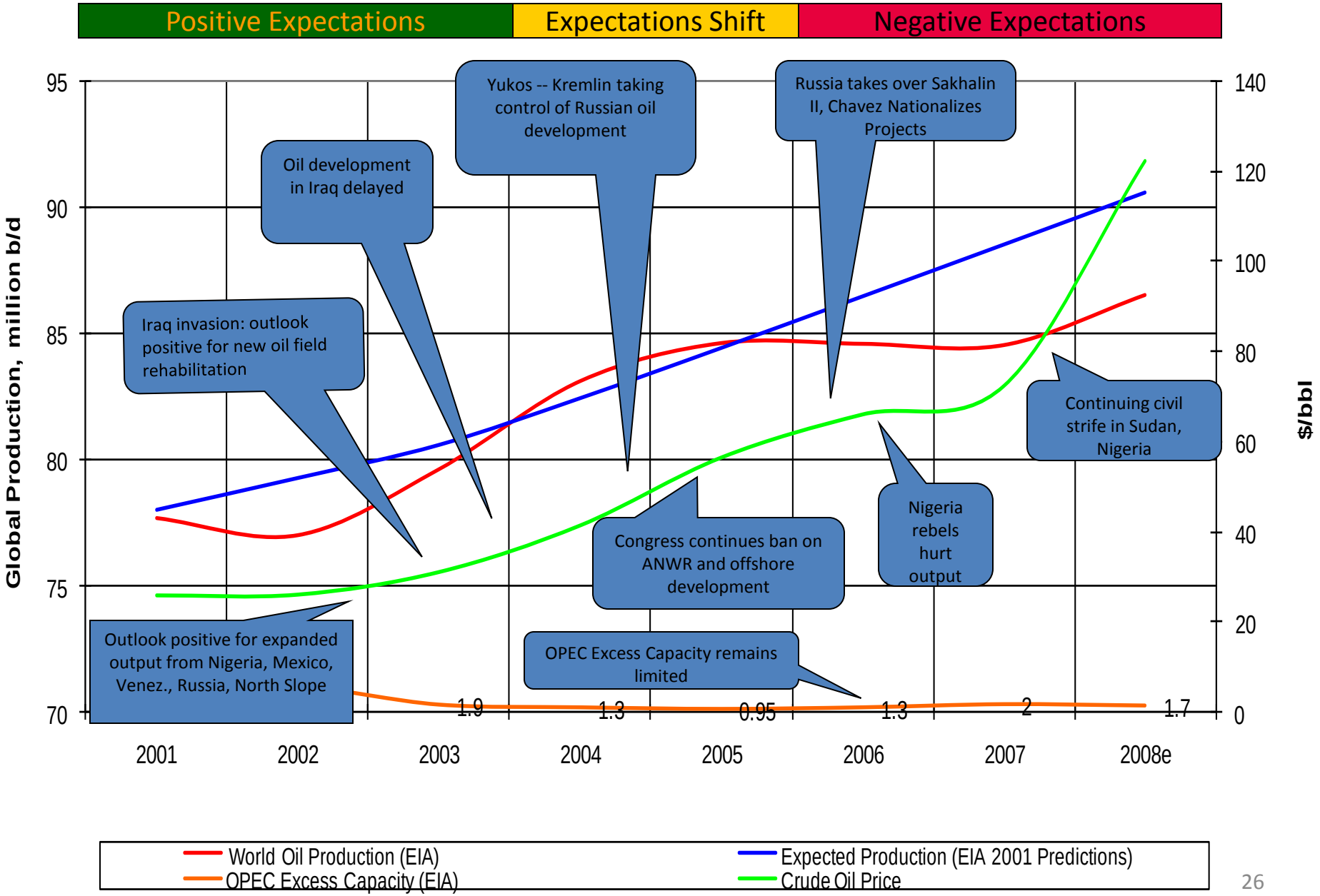
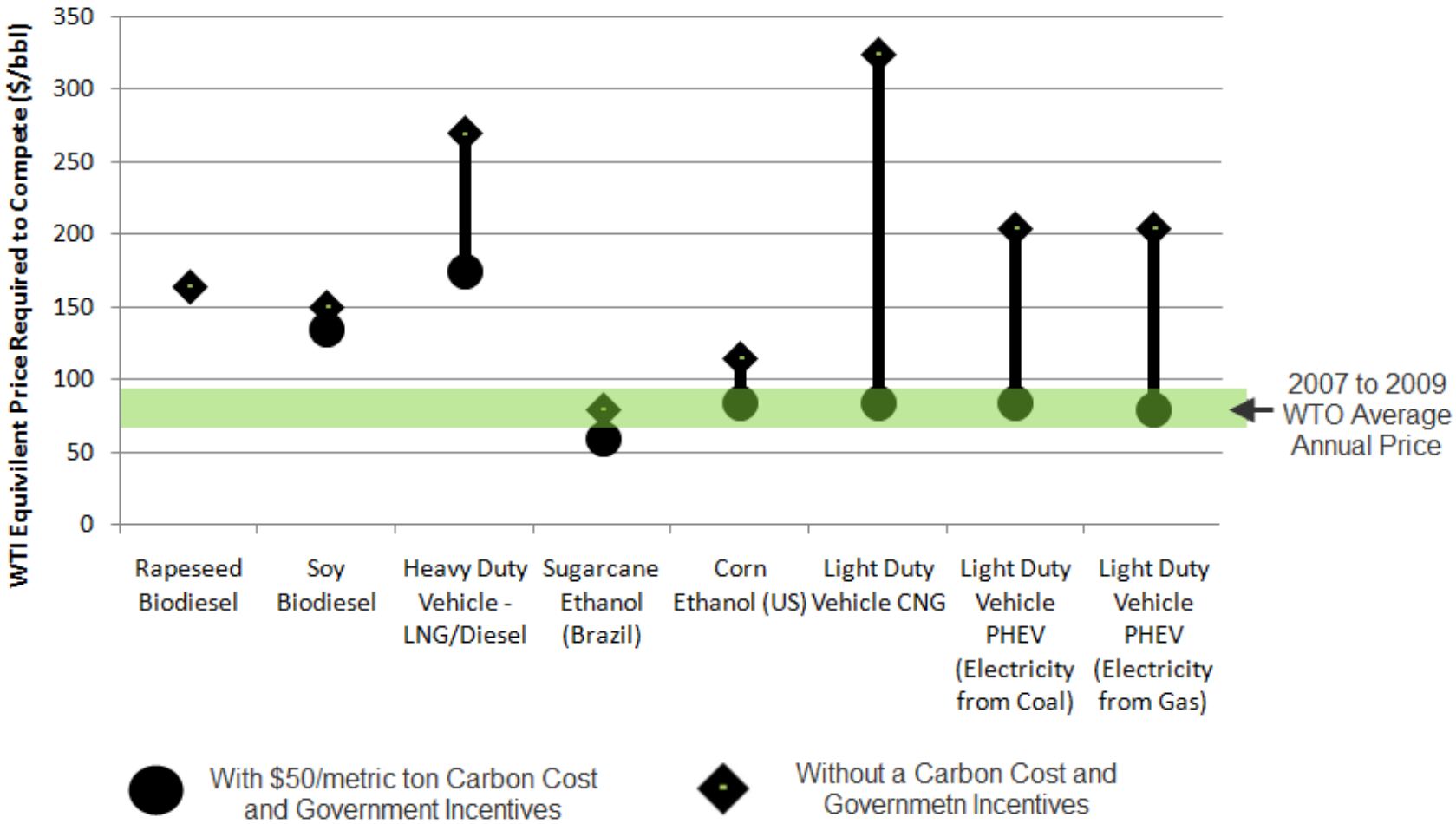
Some Comments on Energy Security, Oil Prices, Role of Expectations, and Conventional Wisdom

A Series of Unfortunate Events Leading to New Expectations



High Oil Prices and Gov't Incentives Required for Alternative Transportation Fuel Technologies to Compete



Source: CERA Data

Take Away

- **Long Run Price of Oil Likely to Place Ambitious Alternative Energy Agenda At Risk of Catastrophic Collapse (already underway).**

- **Assumption of Very High Long Run Oil Prices Likely Incorrect – Understanding Backstop Price for Oil (and Gas) Critical for Policy Formulation.**

- **Energy Security Not Directly Tied to Import Dependence**

- **Climate/Enviromental Control Strategies Should Focus on End Use, Central Planning Solutions Likely to be Costly. Current Strategies Do Not Hold Up Well Under Uncertainty.**

- **Pipeline Infrastructure Critical for Execution of North American Petroleum Renaissance.**