

Paradigm Shift

Building Blocks of the North American Petroleum Renaissance & the Role of Natural Gas

**Hawaii's Energy Landscape:
Global Energy Trends and Their Impact to Hawaii**

**Honolulu
August 17, 2012**

**Lucian Pugliaresi, President
Energy Policy Research Foundation, Inc. (EPRINC)
Washington, DC**

About 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

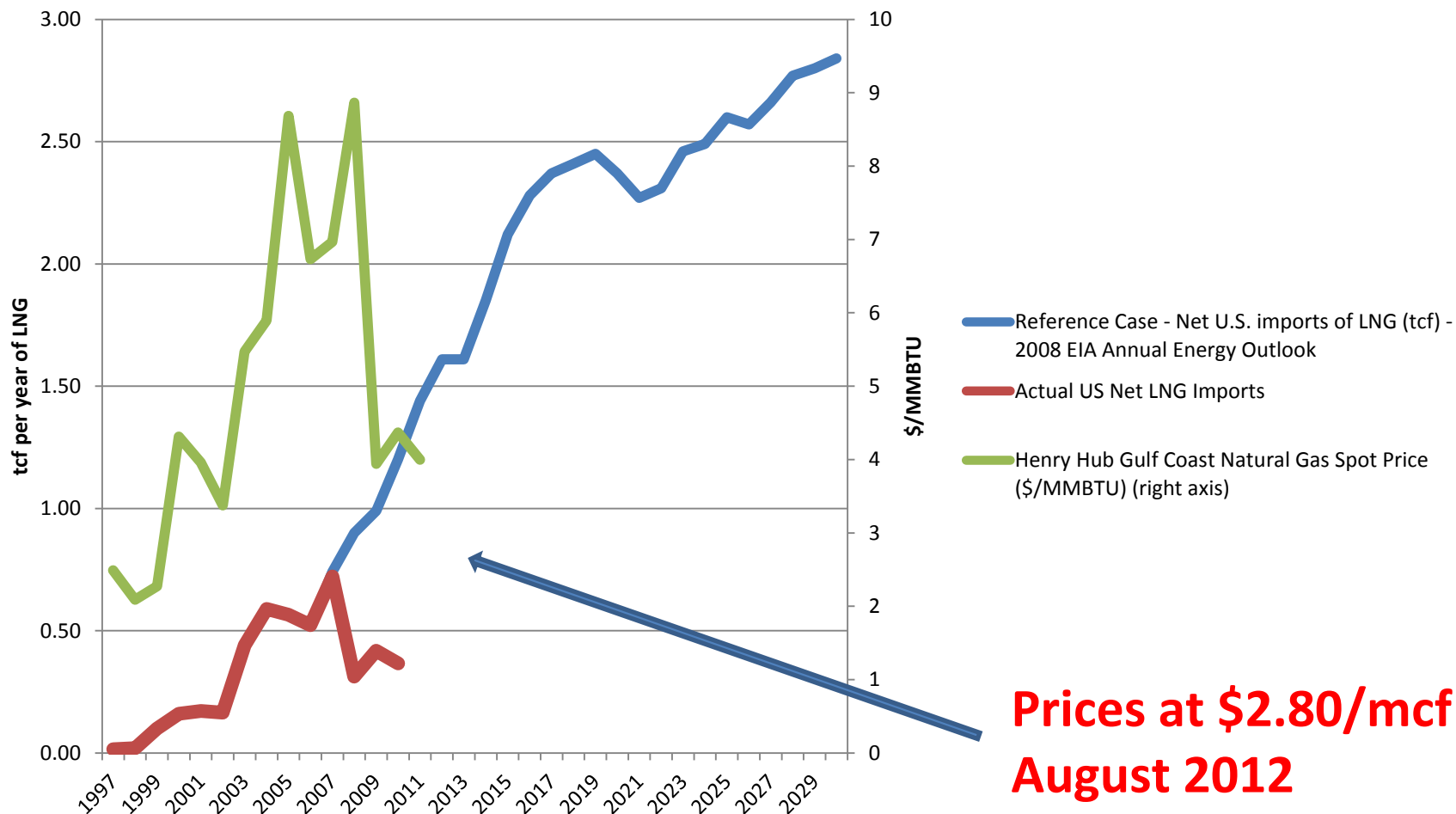
www.eprinc.org -- check out our research



The screenshot shows the EPRINC website with a red header. The header includes the EPRINC logo, the full name "Energy Policy Research Foundation, Inc.", and the Latin motto "emite lucem et veritatem". Below the header is a navigation bar with links: Home, About Us, Events Calendar, Publications, Senior Staff, and Trustees. A Google Custom Search bar is also present. The main content area features a large article titled "Exports, Imports, and Energy Security" with a sub-header "Keystone XL Pipeline and the Role of Canadian Oil Sands". The article is dated December 21, 2011, and includes a link to download a PDF version. The text discusses the economic benefits of the proposed Keystone XL pipeline, the environmental review process, and the Obama Administration's decision to delay a permit. It also mentions opposition from environmental groups and concerns about the project's impact on the U.S. Gulf Coast. A "Read More" link is provided at the end of the article. To the right of the main article is a sidebar with several sections: "BP - Macondo Oil Spill Analysis", "Receive Posts by Email" (with a subscription form), "Recent Posts" (listing "Exports, Imports, and Energy Security", "WSJ Opinion: The Keystone Debacle", "WSJ Opinion: The Lessons of the Shale Gas Revolution", and "The Bakken Boom"), and "Archives" (listing months from January 2012 to April 2010). Below the main article, there is a section for "WSJ Opinion: The Keystone Debacle" featuring a quote from "THE WALL STREET JOURNAL" dated November 16, 2011.

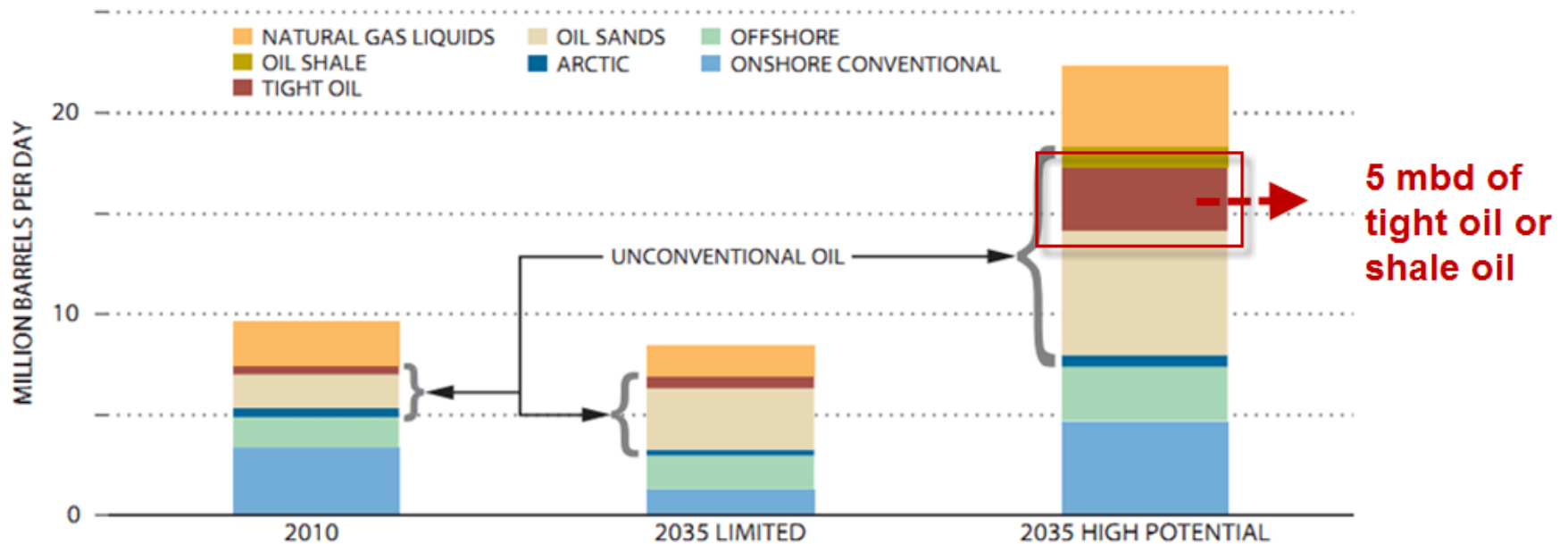
Projected Imports of LNG vs. Actual

(or why forecasters should have humility)



Source : EIA data and forecasts

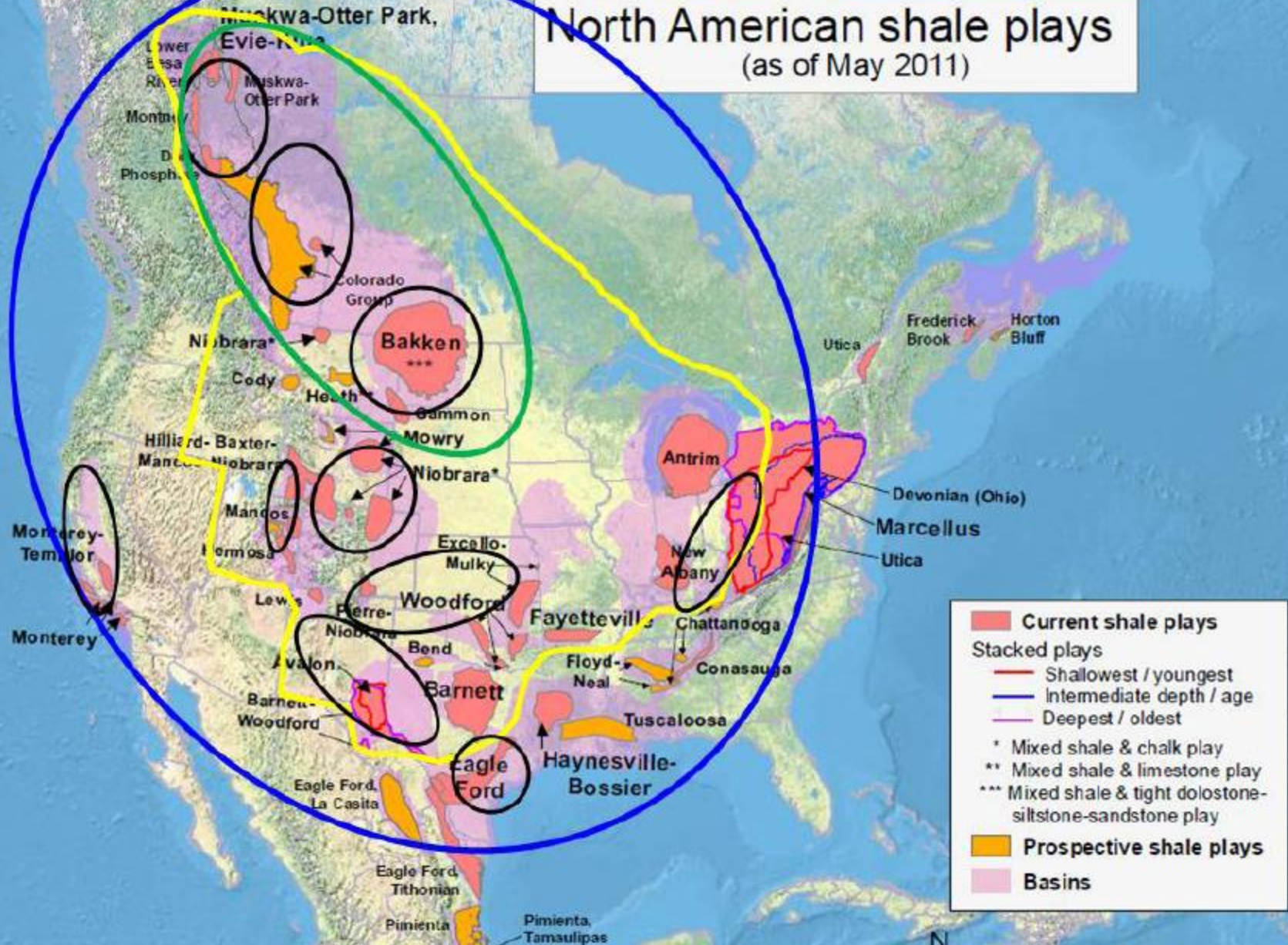
NPC Findings



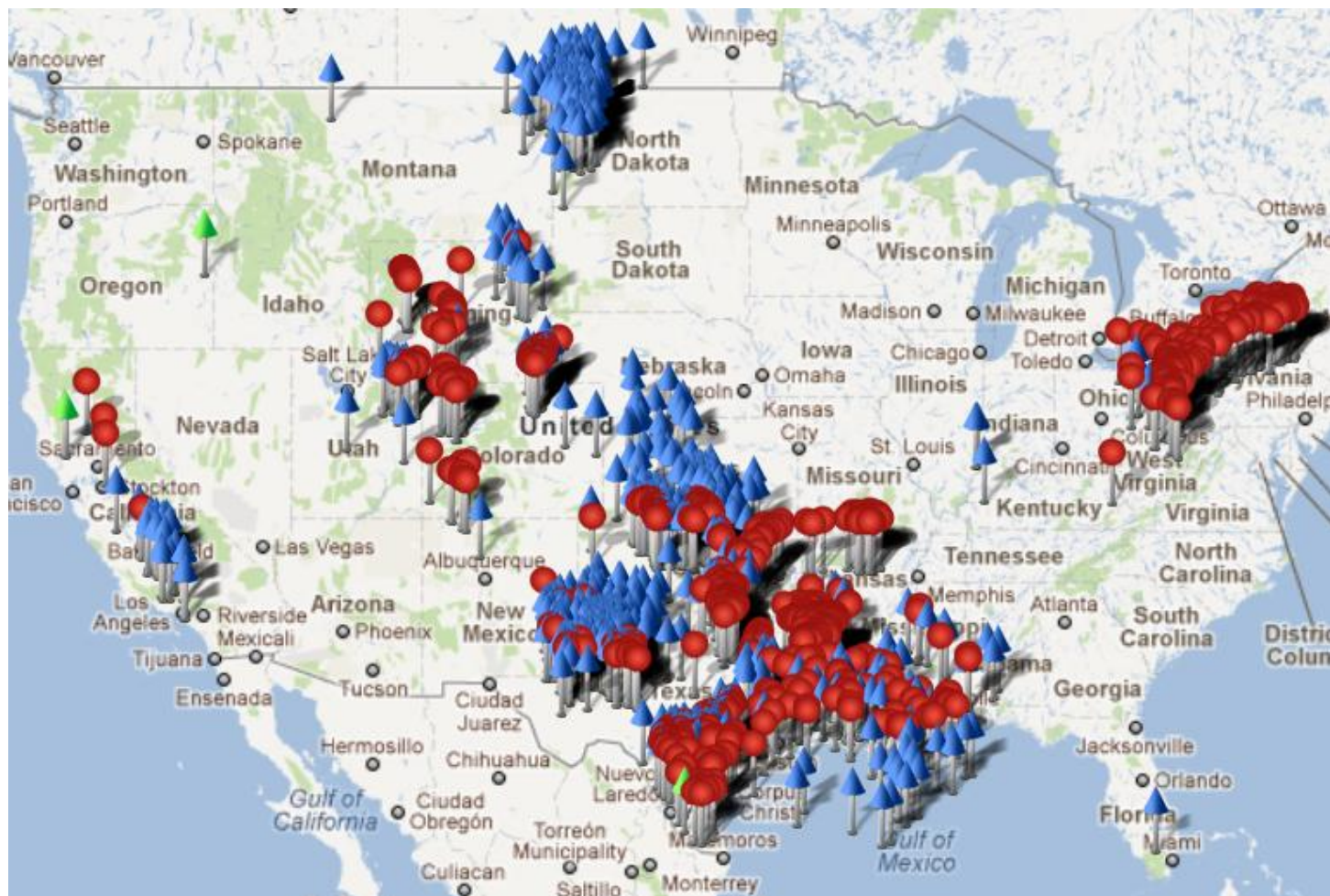
Note: The oil supply bars for 2035 represent the range of potential supply from each of the individual supply sources and types considered in this study. The specific factors that may constrain or enable development and production can be different for each supply type, but include such factors as whether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

North American shale plays (as of May 2011)

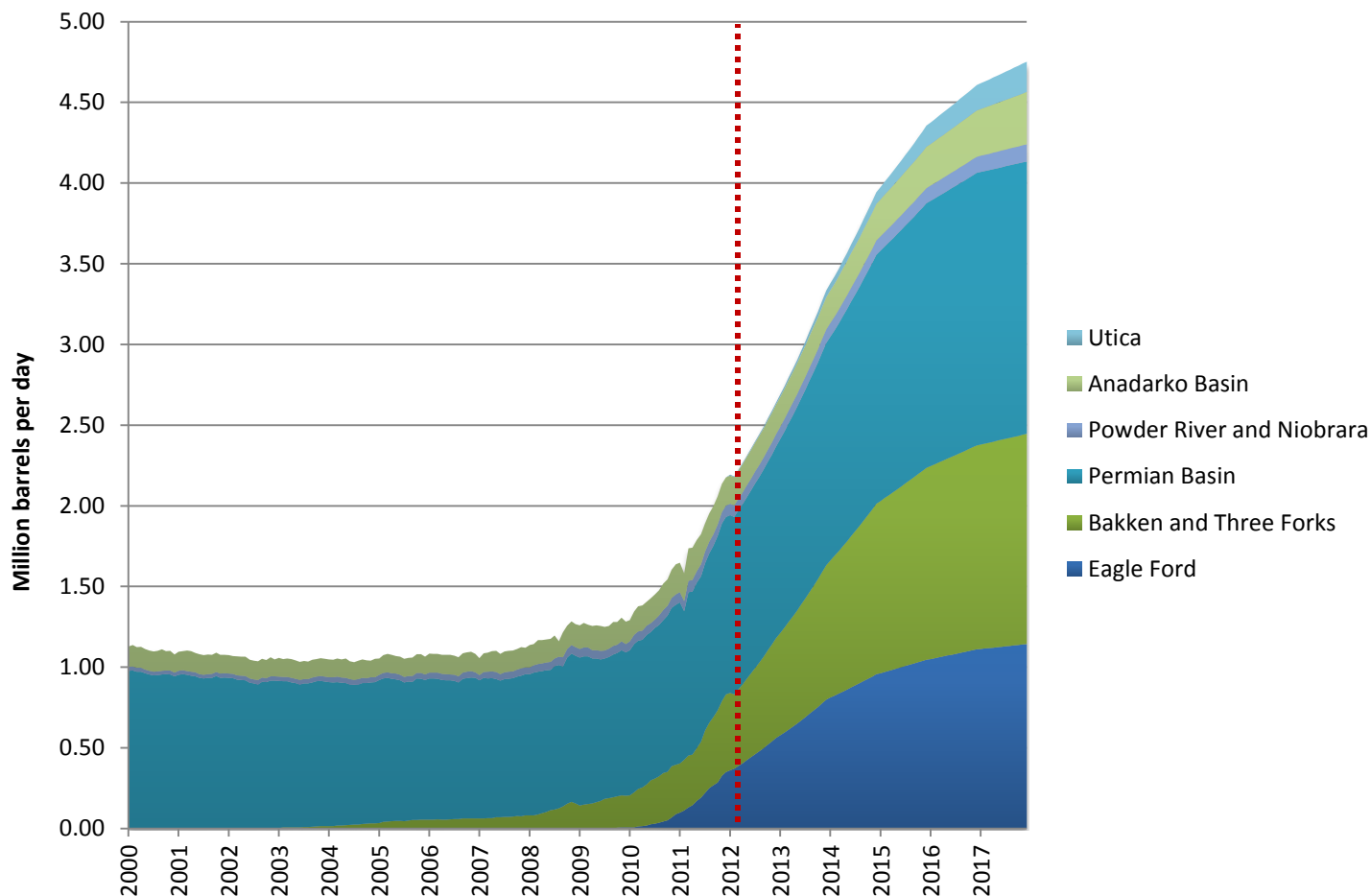


Rig Count and Permits

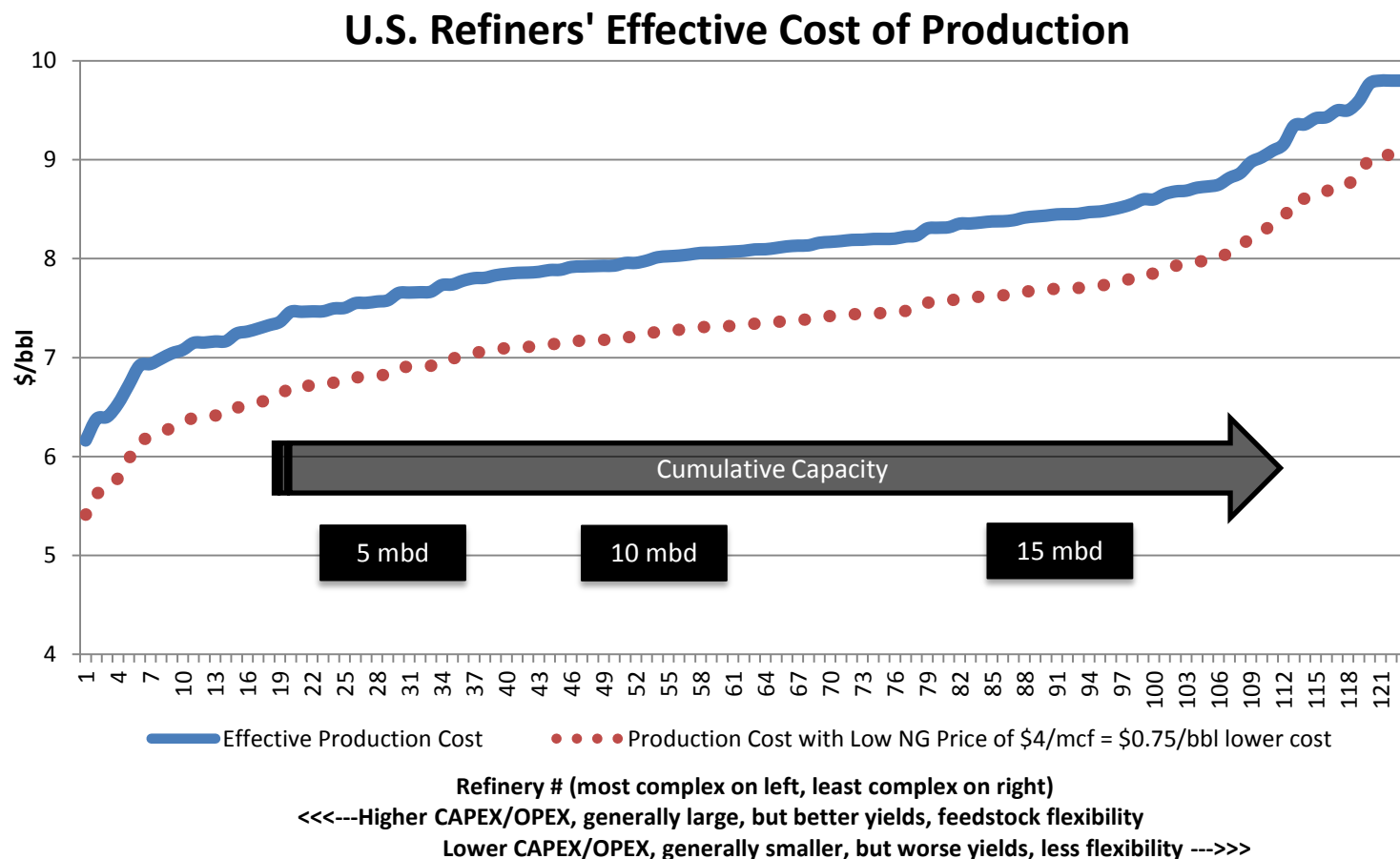


Source: Photo Baker Hughes Interactive Rig Count Jan 25, 2012

Forecasted Production from Selected Plays



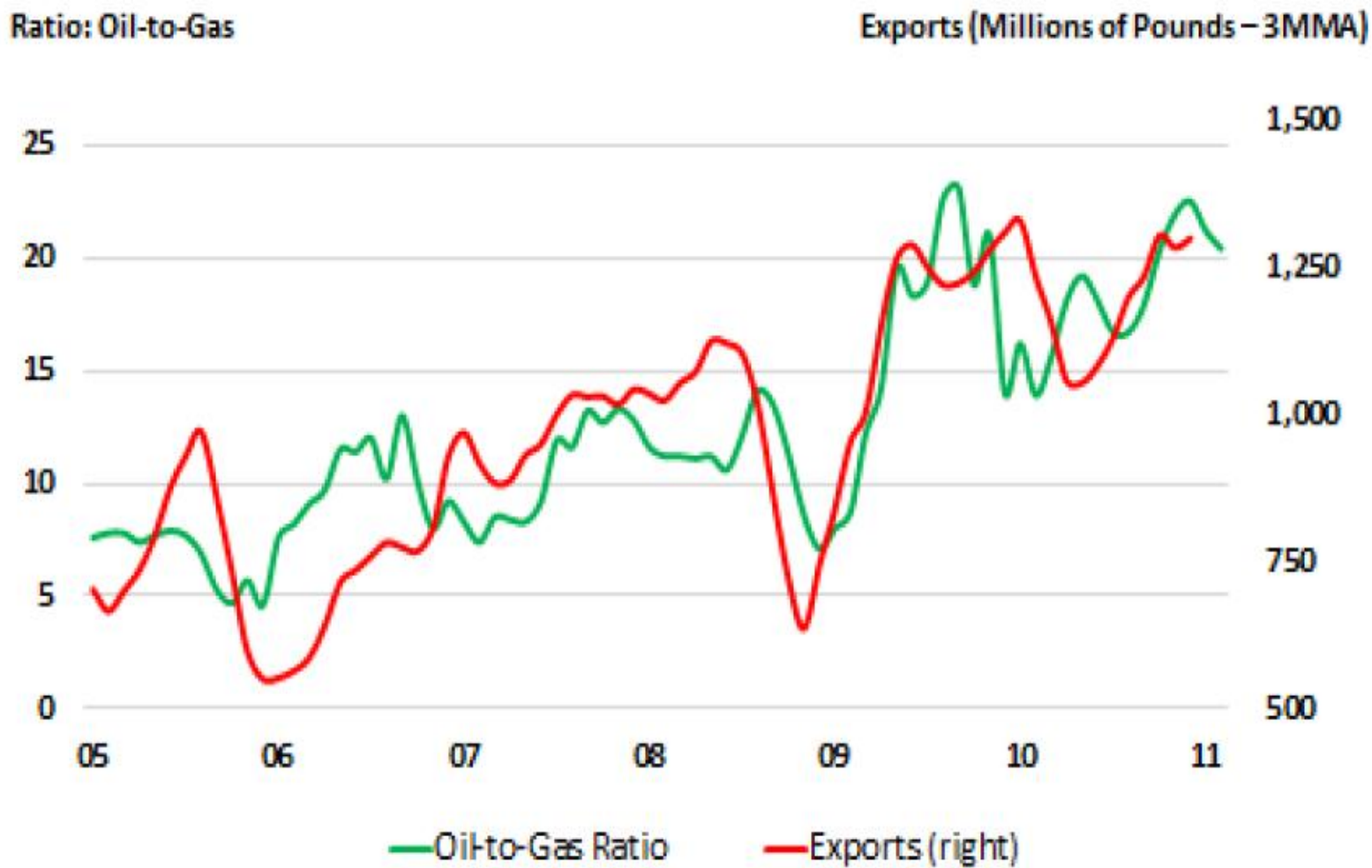
Low Cost Natural Gas Lowers Production Costs



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

Thermoplastic Exports and Oil-to-Gas Ratio



Source: American Chemistry Council

Petrochemical Cost Curve , By Country 2010

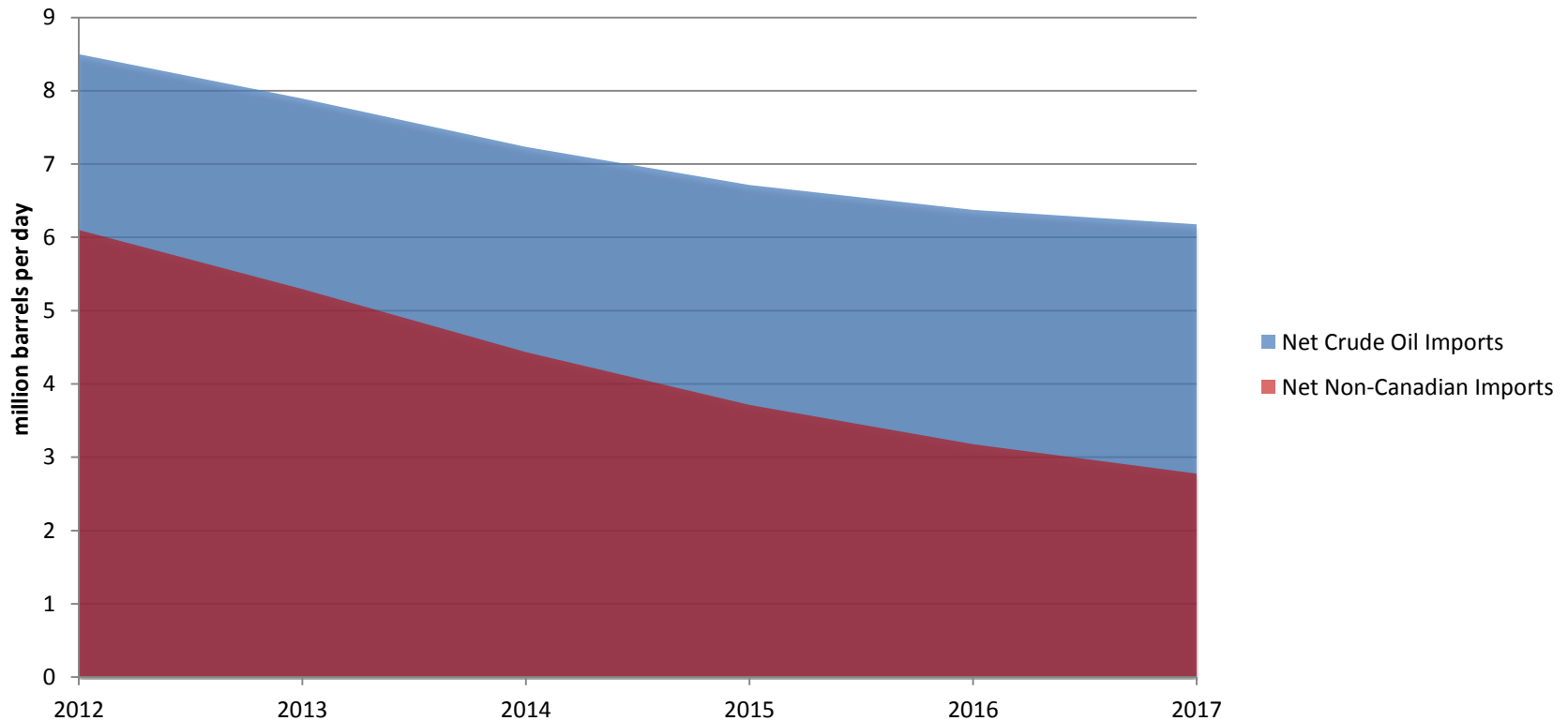
Cash Costs
(\$/Pound)

High



Source: American Chemistry Council

Resulting Decline in US Net Imports*



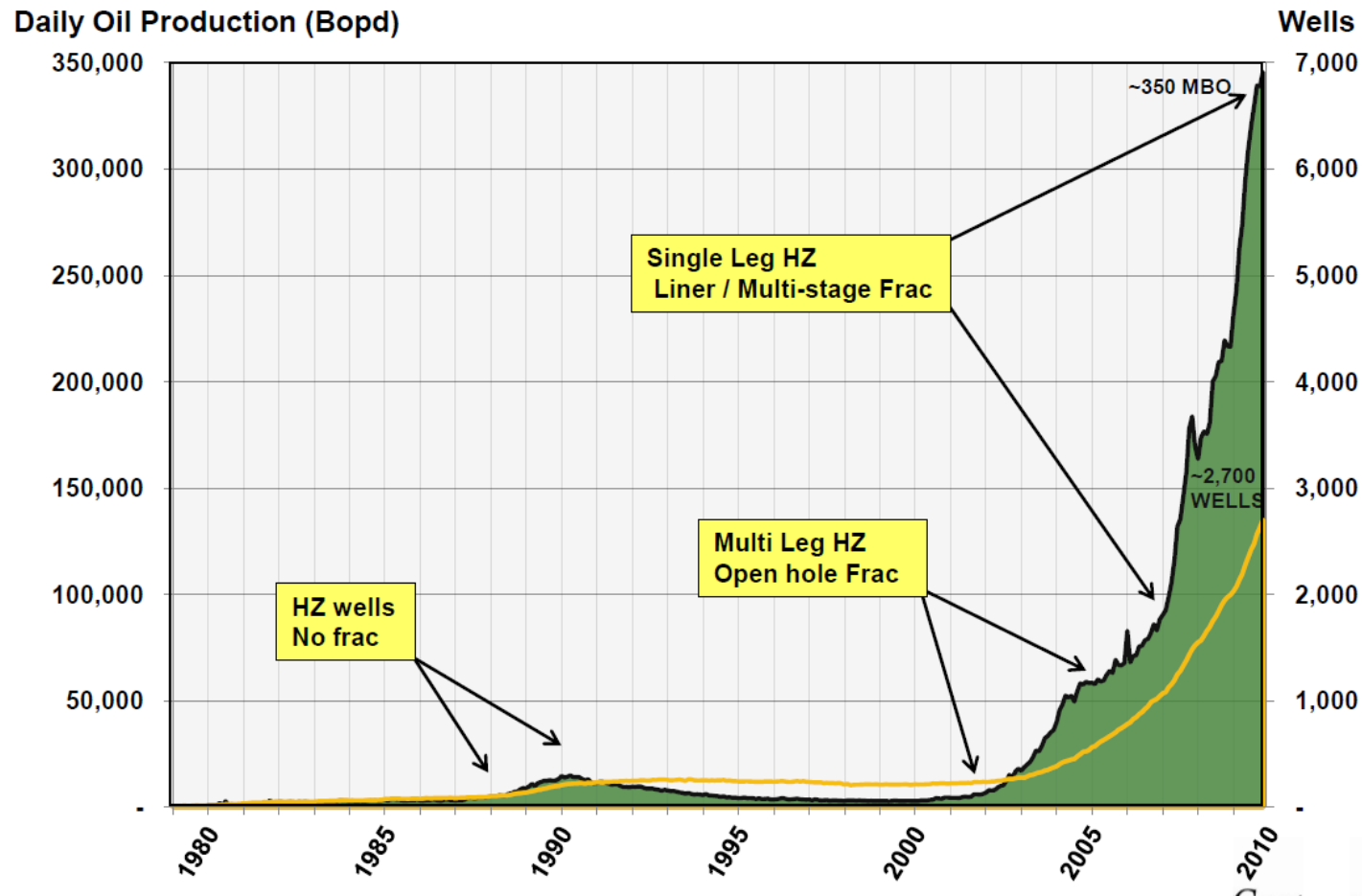
*Holds all US crude oil and biofuel production constant except for the plays listed in the previous slides. Assumes 1 mm bd of Canadian production growth dispersed evenly over 5 years, and that all incremental Canadian production enters the US. Also assumes US demand remains unchanged from current levels.

Various Shale Gas Reserve Estimates—Probably Low and Clearly Uncertain Given Technological Advances

Analysis Group	Reserve Estimate(tcf)
ICF International	1,842
Advanced Resources International	1,189
Energy Information Administration (EIA) <i>2011 estimate</i>	827
Potential Gas Committee	68

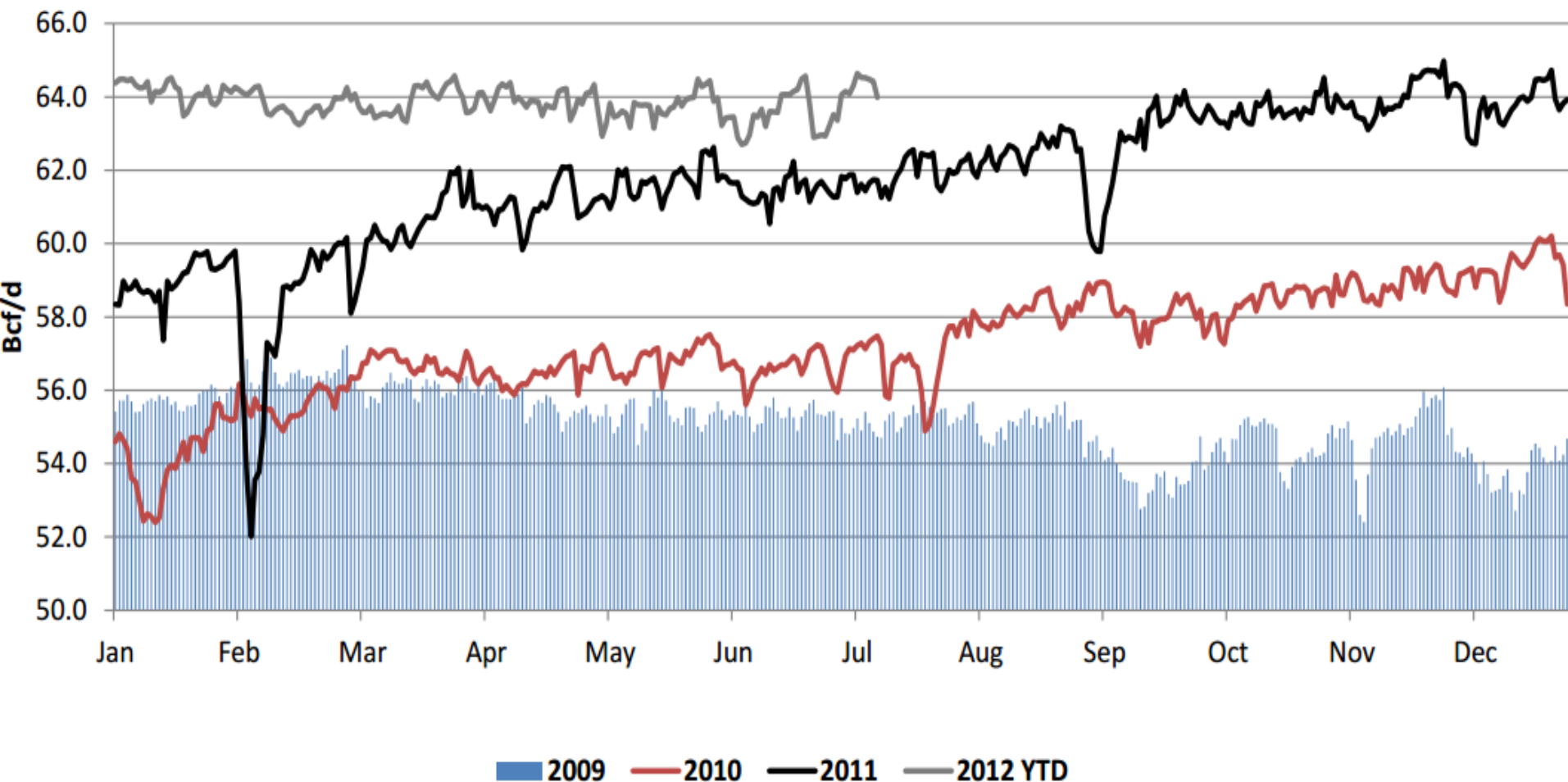
Source: ICF, ARI, EIA, and Potential Gas Committee

Williston Basin Production Forecasts



Source: Continental Resources , from Platts Midstream Development & Management Conference, May 12, 2011 NDPA

Historical US Gas Production

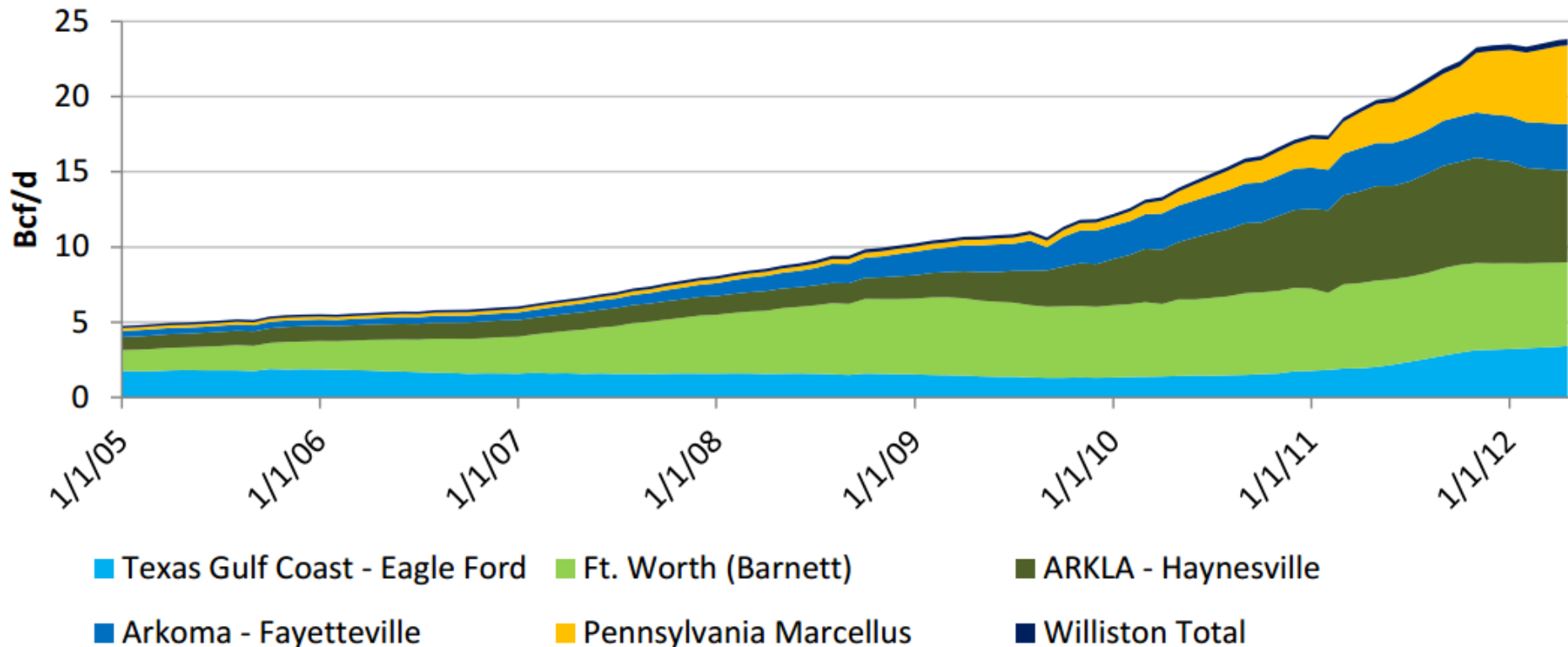


■ 2009 ■ 2010 ■ 2011 ■ 2012 YTD

Source: Bentek, NDPA Williston Basin natural gas study, "The Williston Basin: Greasing the Gears for Growth in North Dakota"

Dry Production from Major U.S. Shale Plays

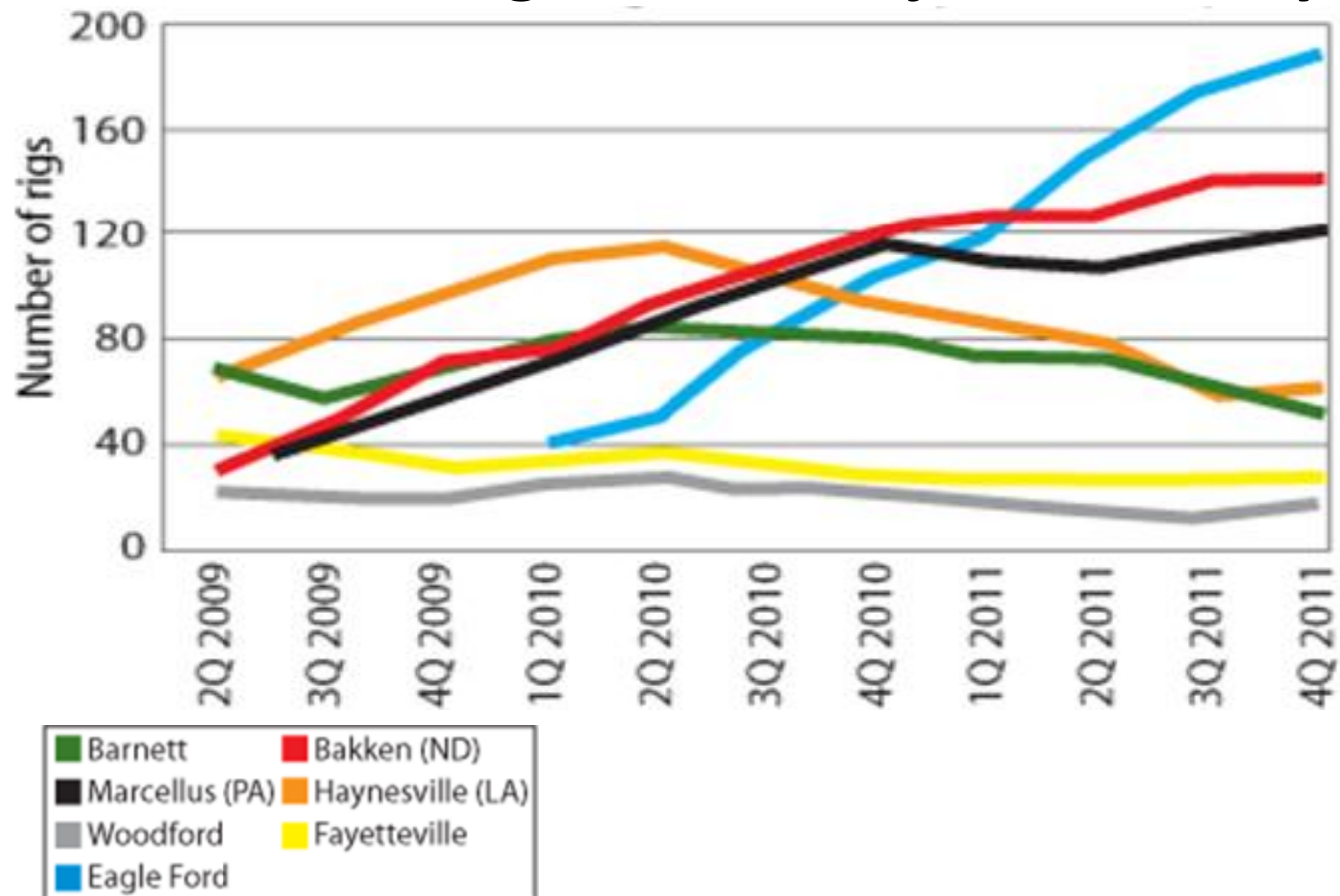
Dry Production from Major U.S. Shale Plays



SOURCE: HPDI

Bentek, NDPA Williston Basin natural gas study, "The Williston Basin: Greasing the Gears for Growth in North Dakota"

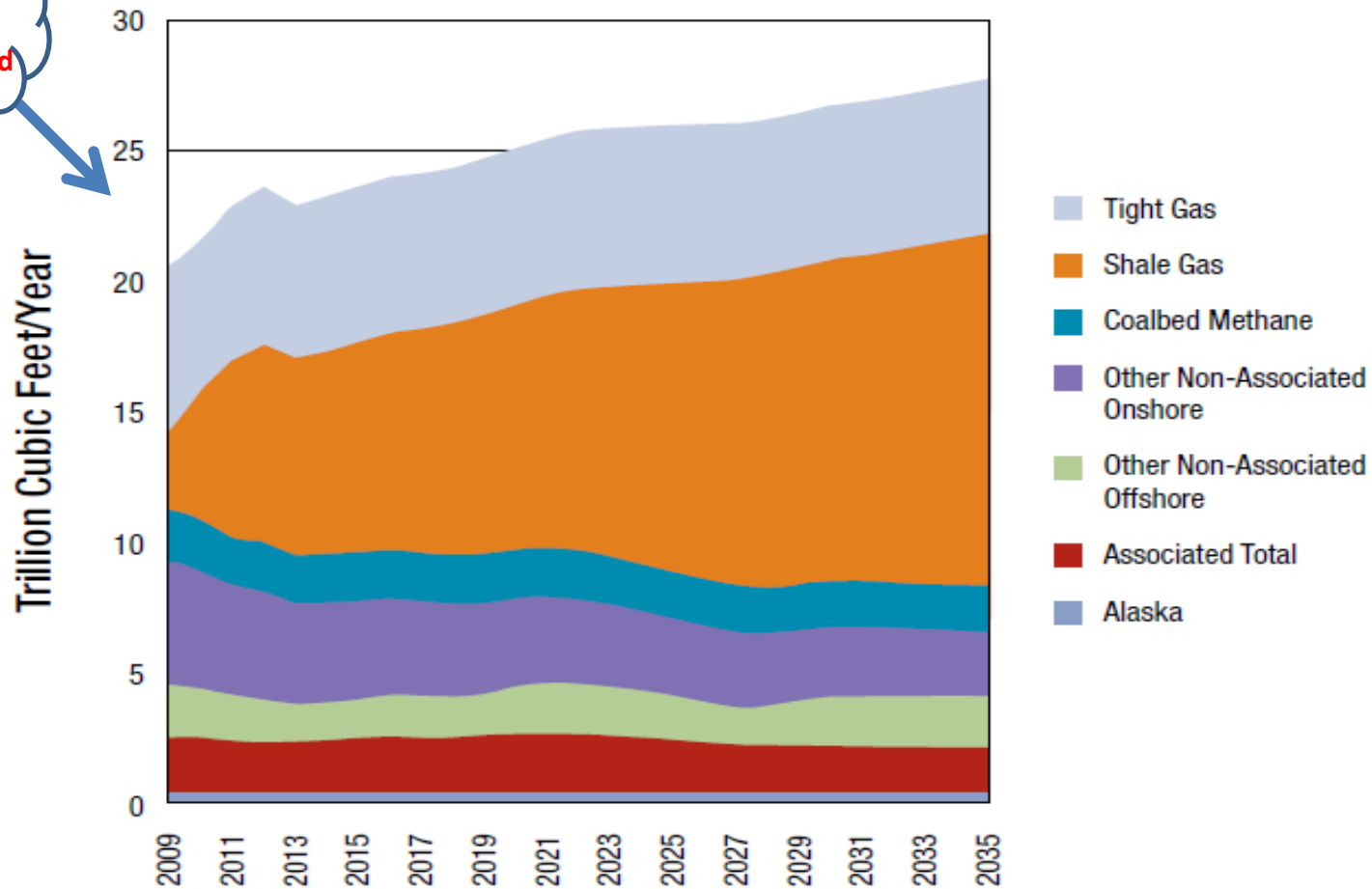
Natural Gas and Rig Counts, Major Shale Plays



Source: Baker Hughes rig reporting

U.S. Natural Gas Supply

1.5 tcf
exported



Source: EIA, 2011 Energy Outlook

Net Imports from Canada

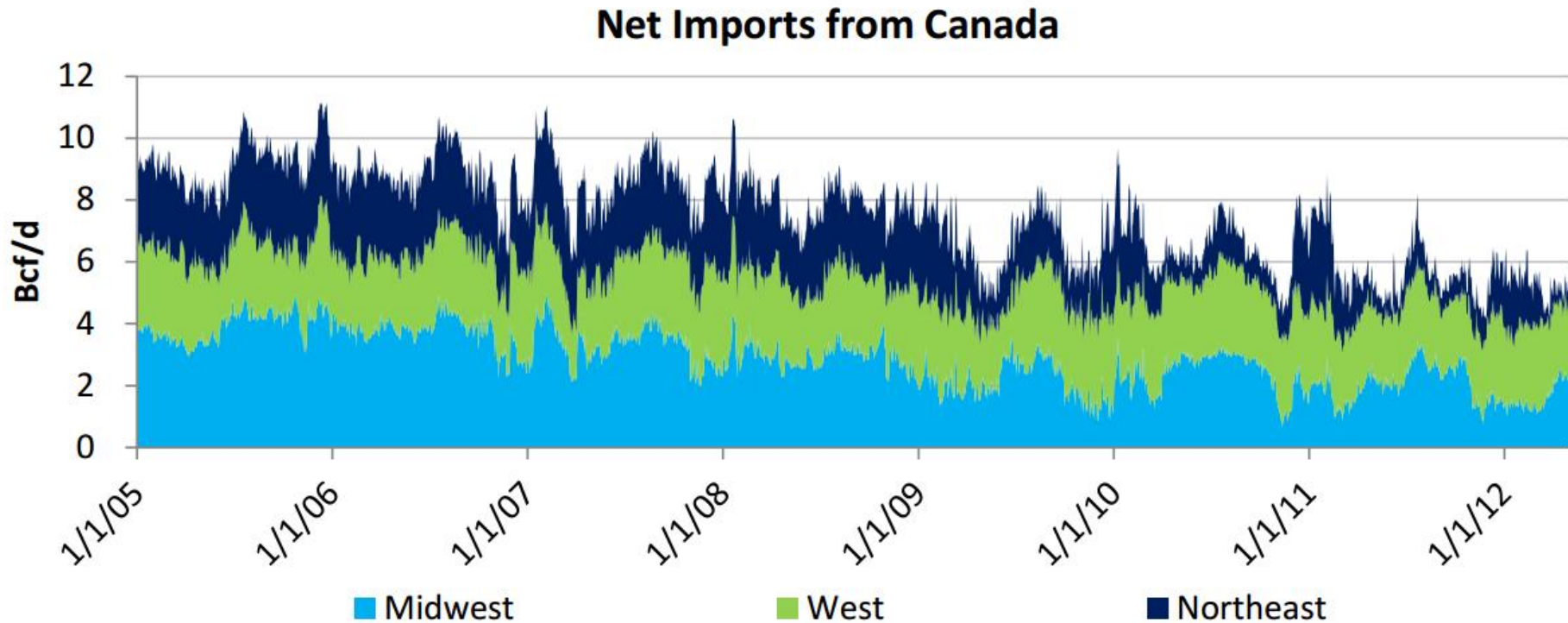


Figure 5. SOURCE: BENTEK

DOE Study on Natural Gas Prices and LNG Exports

Scenario →					
Case ↓	Baseline Scenario Projected Natural Gas Price in 2025 (\$/mcf)	Low Export- Slow Growth	Low Export- Rapid Growth	High Export- Slow Growth	High Export- Rapid Growth
Reference Case	\$4.70	10.0%	12.8%	14.3%	25.7%
High Shale EUR	\$3.56	9.6%	12.9%	13.2%	24.2%
Low Shale EUR	\$6.52	13.7%	17.0%	20.2%	32.5%
High Macroeconomic Growth	\$4.99	11.0%	13.4%	15.6%	28.1%

Source: "Effect of Increased Natural Gas Exports on Domestic Energy Markets," Energy Information Administration, January 2012.

Note: U.S. natural gas exports (almost all by pipeline to Mexico and Canada), grew by 2 bcf/d between 2006-2011

Average Price Impact by Various Analysts, 2015-2035, 6 bcf/d of LNG Exports

Study	Average Price without Exports (\$/MMBtu)	Average Price with Exports (\$/MMBtu)	Average Price Increase (%)
EIA*	\$5.28	\$5.78	9%
Deloitte	\$7.09	\$7.21	2%
Navigant (2010)** (2 bcf/day of exports)	\$4.75	\$5.10	7%
Navigant (2012)***	\$5.67	\$6.01	6%
ICF International***	\$5.81	\$6.45	11%

Source: Energy Security Initiative, Brookings Institution, Liquid Markets: Assessing the Case for U.S. Exports of LNG, May 2012

Haynesville Breakeven Estimate Worksheet

First well and Additional Wells with a 25% Royalty

Initial (First) Well per Lease Section (recovering 100% of lease bonus)

Lease Costs per Acre	\$	5,000.00	\$	7,500.00	\$	10,000.00	\$	12,500.00	\$	15,000.00
Acres per Section		640		640		640		640		640
Initial Lease Bonus Costs	\$	3,200,000.00	\$	4,800,000.00	\$	6,400,000.00	\$	8,000,000.00	\$	9,600,000.00
Drilling-Frac-Completion Costs	\$	9,000,000.00	\$	9,000,000.00	\$	9,000,000.00	\$	9,000,000.00	\$	9,000,000.00
Total Costs For Initial Well	\$	12,200,000.00	\$	13,800,000.00	\$	15,400,000.00	\$	17,000,000.00	\$	18,600,000.00

Break Price per EUR on 25% Royalty

4 BCF EUR	\$	4.07	\$	4.60	\$	5.13	\$	5.67	\$	6.20
5 BCF EUR	\$	3.25	\$	3.68	\$	4.11	\$	4.53	\$	4.96
6 BCF EUR	\$	2.71	\$	3.07	\$	3.42	\$	3.78	\$	4.13
7 BCF EUR	\$	2.32	\$	2.63	\$	2.93	\$	3.24	\$	3.54
8 BCF EUR	\$	2.03	\$	2.30	\$	2.57	\$	2.83	\$	3.10
9 BCF EUR	\$	1.81	\$	2.04	\$	2.28	\$	2.52	\$	2.76
10 BCF EUR	\$	1.63	\$	1.84	\$	2.05	\$	2.27	\$	2.48

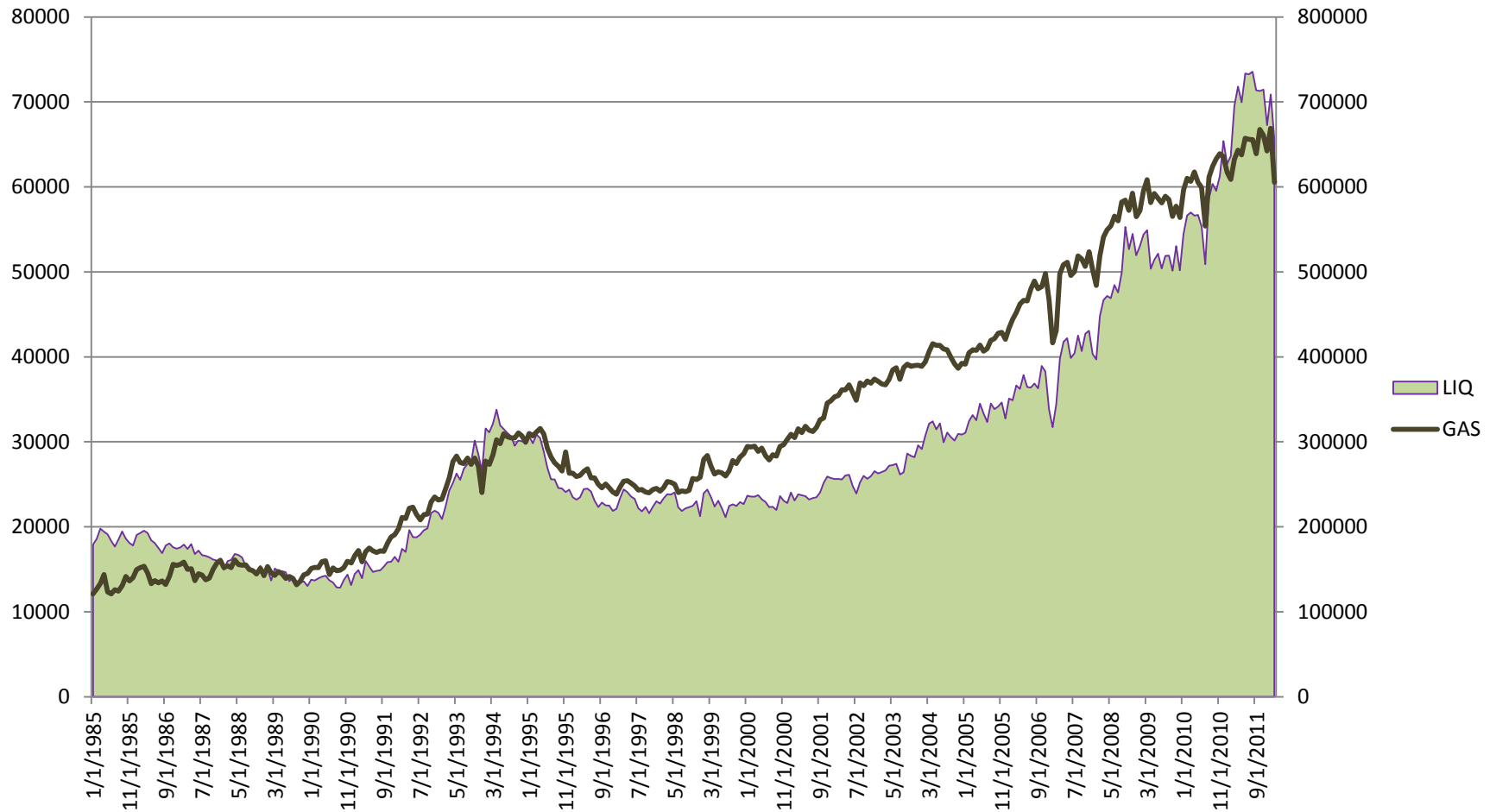
Additional Wells (No additional lease costs)

Lease Costs per Acre	\$	5,000.00	\$	7,500.00	\$	10,000.00	\$	12,500.00	\$	15,000.00
Acres per Section		640		640		640		640		640
Additional Well Lease Costs	\$	-	\$	-	\$	-	\$	-	\$	-
Drilling-Frac-Completion Costs	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00
Total Costs For Initial Well	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00	\$	8,500,000.00

Break Price per EUR on 25% Royalty

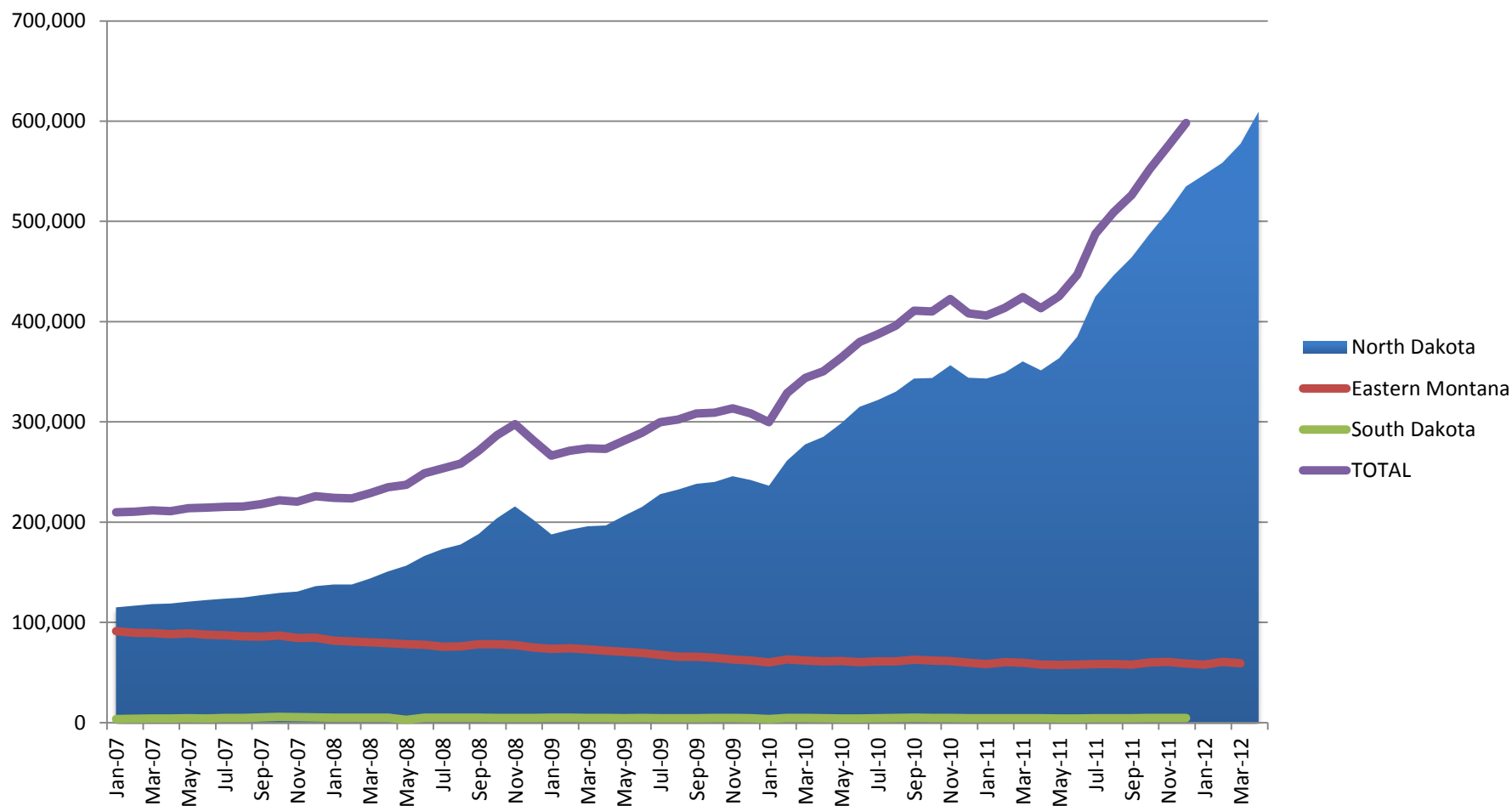
4 BCF EUR	\$	2.83	\$	2.83	\$	2.83	\$	2.83	\$	2.83
5 BCF EUR	\$	2.27	\$	2.27	\$	2.27	\$	2.27	\$	2.27
6 BCF EUR	\$	1.89	\$	1.89	\$	1.89	\$	1.89	\$	1.89
7 BCF EUR	\$	1.62	\$	1.62	\$	1.62	\$	1.62	\$	1.62
8 BCF EUR	\$	1.42	\$	1.42	\$	1.42	\$	1.42	\$	1.42
9 BCF EUR	\$	1.26	\$	1.26	\$	1.26	\$	1.26	\$	1.26
10 BCF EUR	\$	1.13	\$	1.13	\$	1.13	\$	1.13	\$	1.13

Niobrara Production



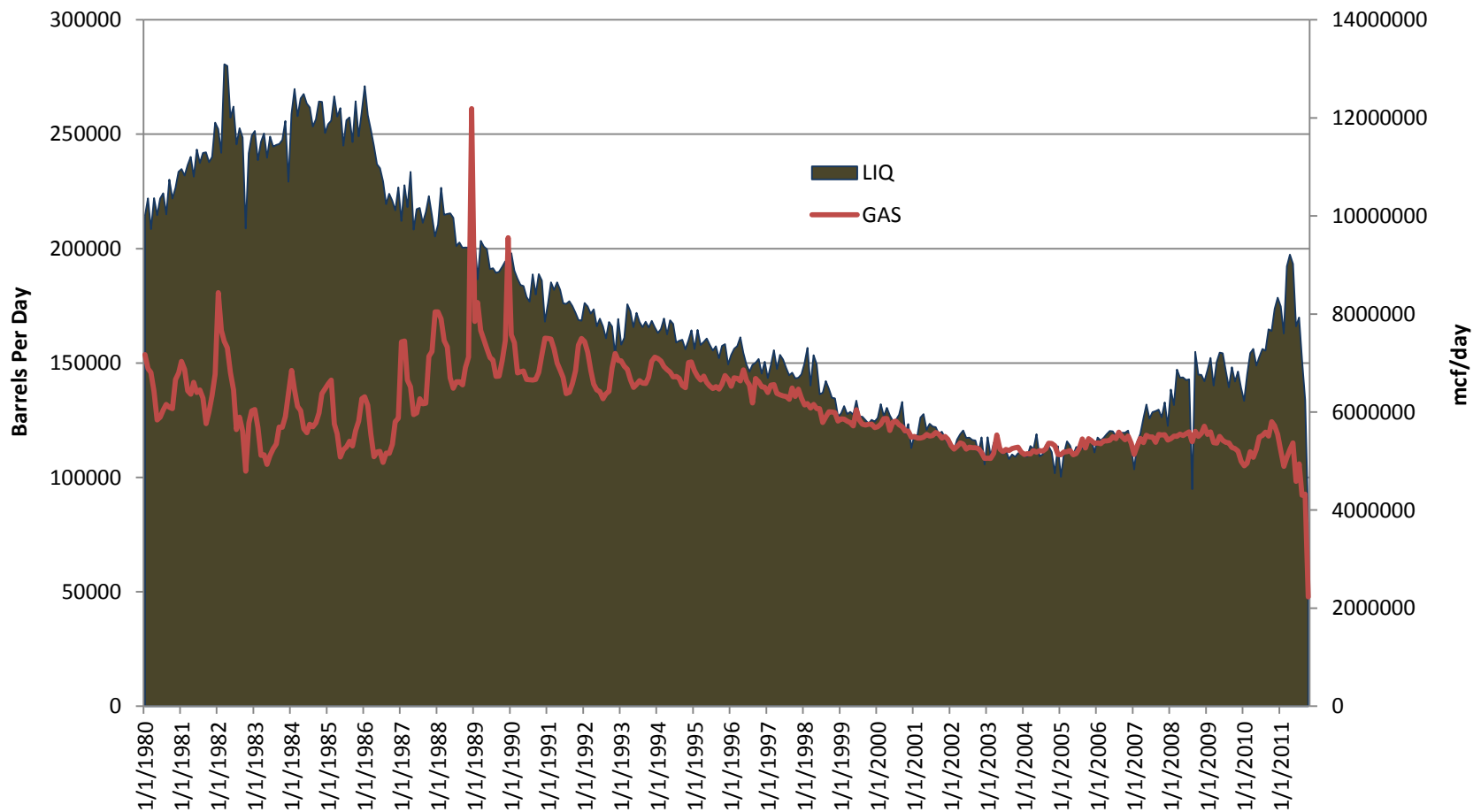
Source : EIA data and forecasts

Williston Basin Production



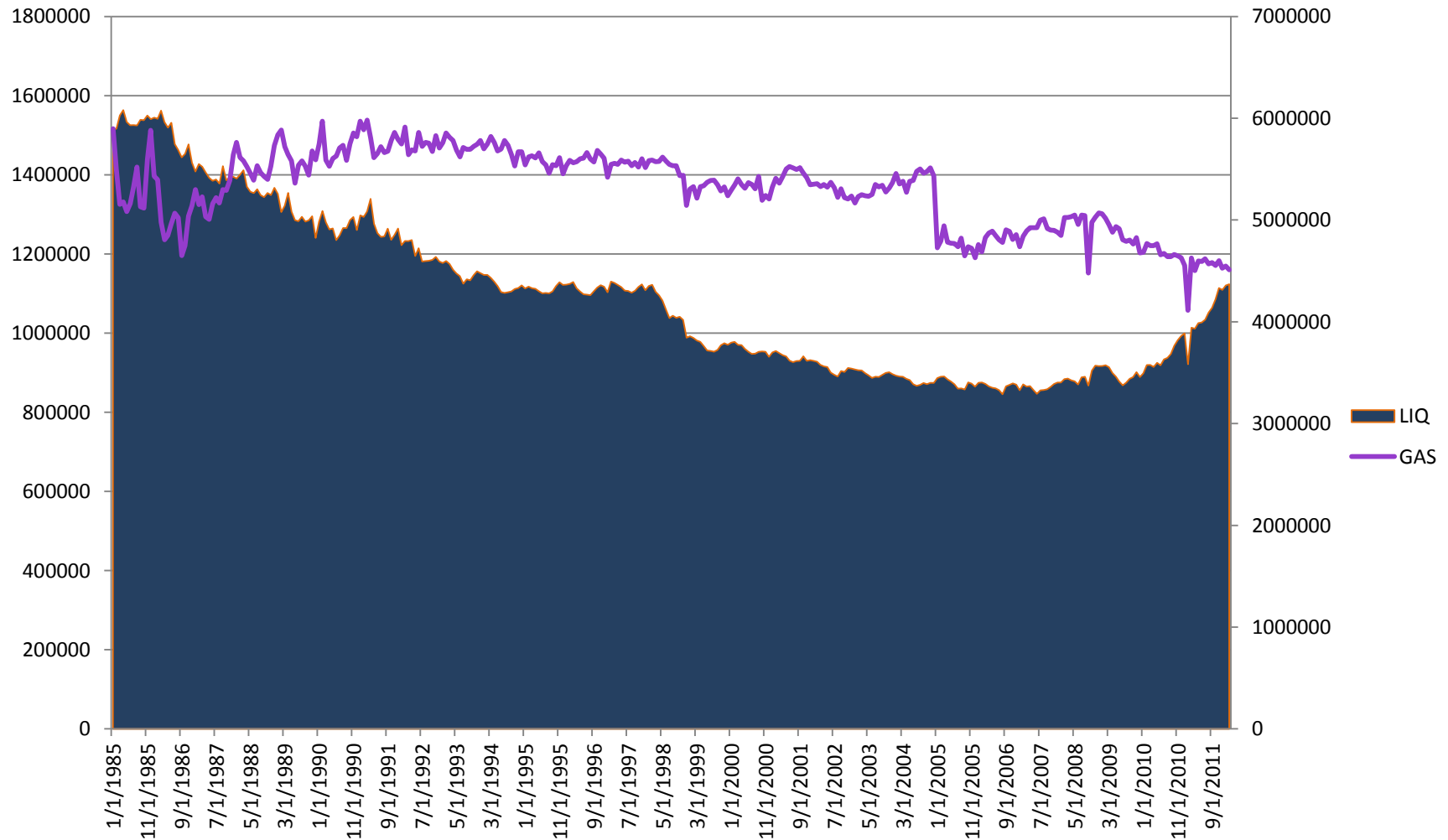
Source : NDPA, HPDI

Anadarko Basin Production



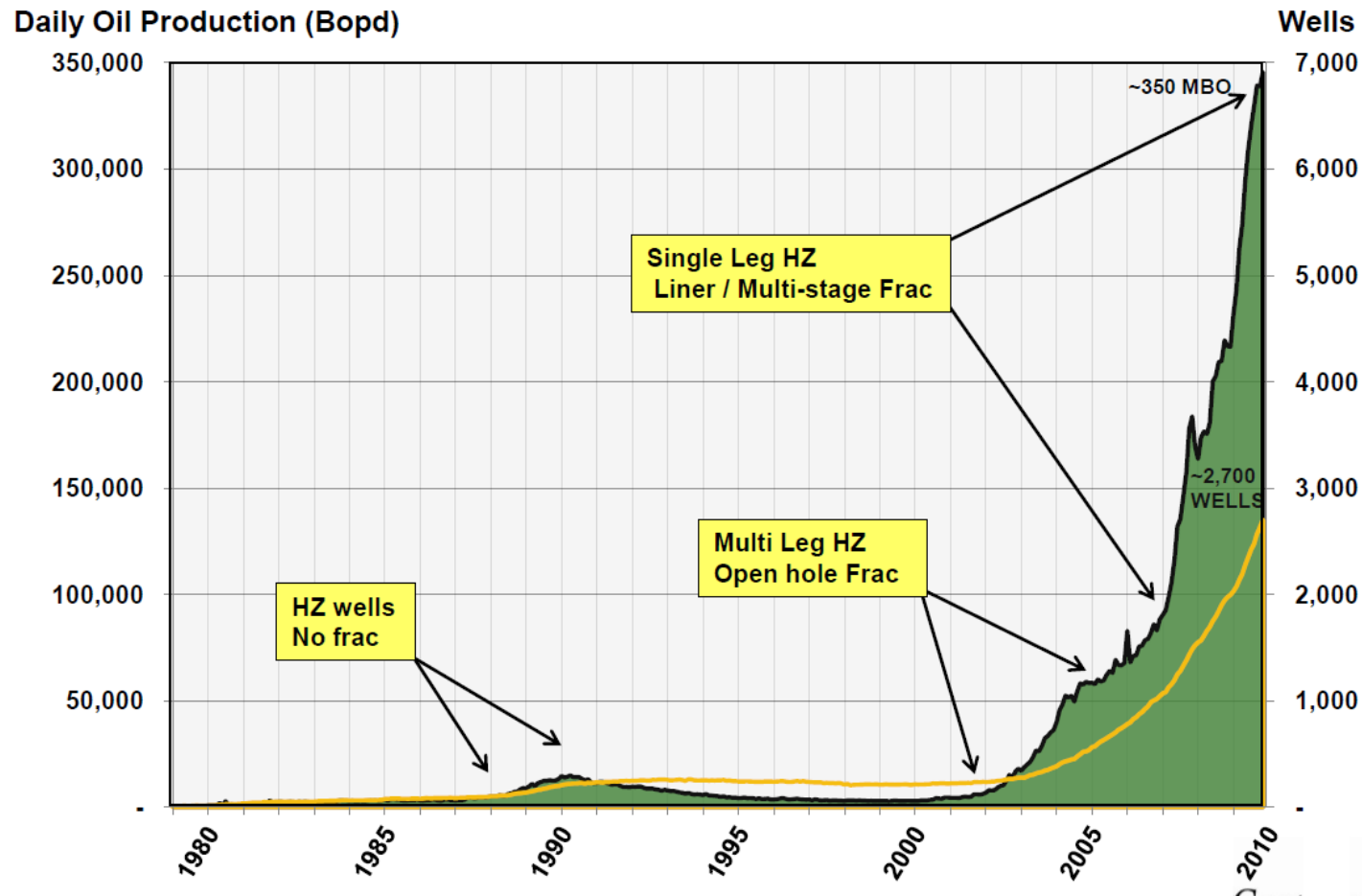
Source: HPDI Feb 8 2012

Permian Basin Production (March 2012)



Source: HPDI June 12 2012

Williston Basin Production Forecasts



Source: Continental Resources , from Platts Midstream Development & Management Conference, May 12, 2011 NDPA

Will Public Opposition Stop the Shale Gale?

24 HOURS LATER ... SYRACUSE PULLS PLUG

Security concerns zap EPA meeting



Photo illustration by JOHN CATLETT / Graphics Editor

The EPA has conducted three hydrofracking meetings around the country without incident, but none of them attracted the number of people that were expected to be at Thursday's now-postponed meeting. Officials from the City of Syracuse and Onondaga County

September eyed as earliest date, but site uncertain

By Jon Campbell
jcampbell1@gannett.com
Staff Writer

It was on. It was moved. Now, it's off — at least until September.

Less than 24 hours after the U.S. Environmental Protection Agency announced it was moving its marathon public meeting from Binghamton University to the Oncenter Complex in Syracuse, the agency Tuesday postponed the event because of security concerns expressed by Onondaga County officials.

Matthew Millea, deputy county executive for physical services for Onondaga, said public safety officials at BU told Onondaga to expect up to 8,000 people to show for the event.

About 1,200 people had pre-registered to attend the hearing, but a large walkup crowd was expected.

"It was just impossible to put together a plan that would ensure public health and safety for a crowd of that size in this period of time," Millea said.

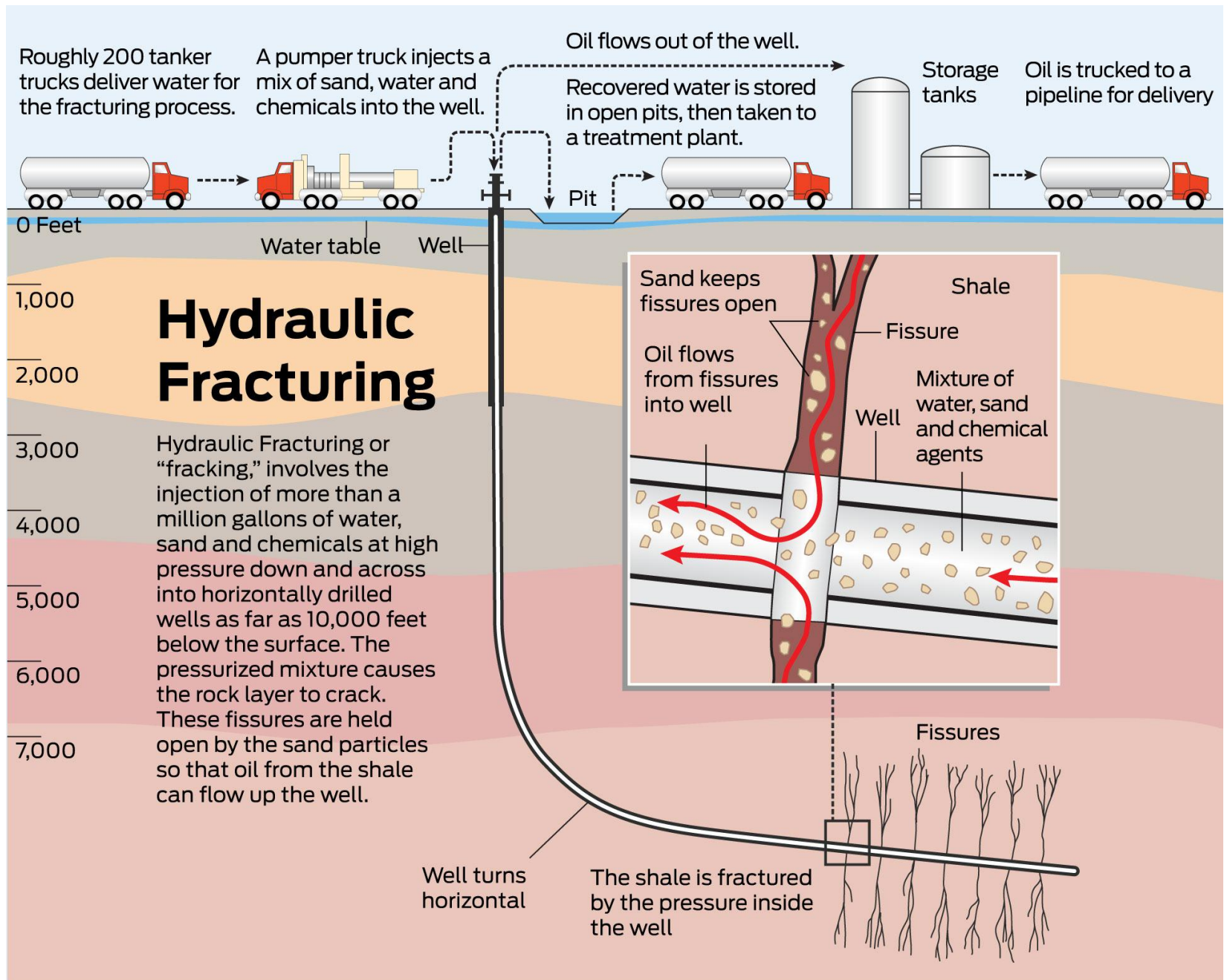
This was the latest in a number of twists and turns for the meeting, which was set for Thursday. On Monday it was moved to Syracuse because of a week-

contract dispute between the EPA and BU. The agency now intends to hold the meeting

BACK IN BROOME?

If the Environmental Protection Agency's meeting on hydrofracking is rescheduled for September, Broome County might be able to schedule it at one of its venues, said Arena Director Brian Hoffman. Hosting the meeting at a county venue depends on the events already scheduled at the facilities.

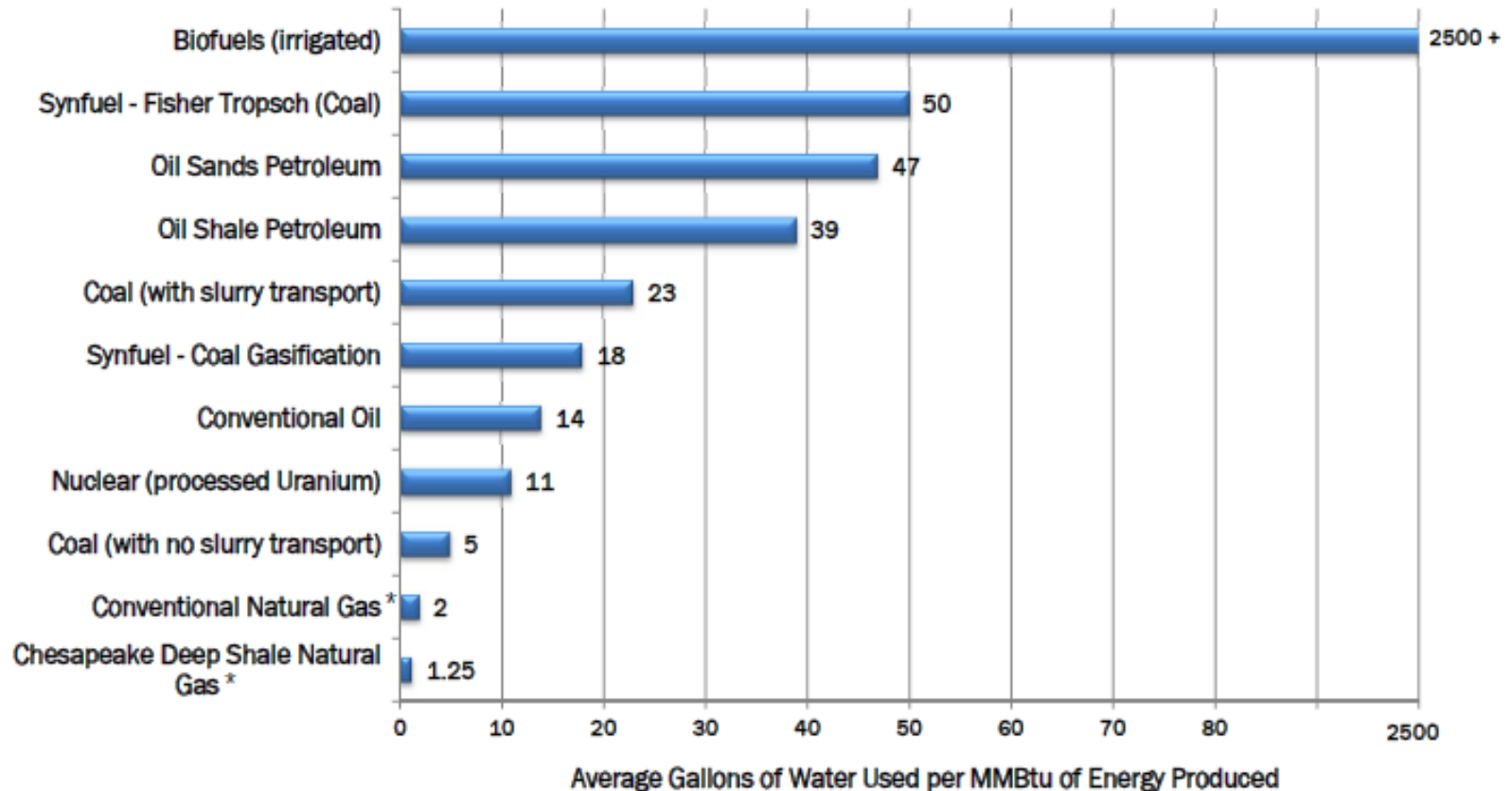
SEE RELATED STORY, 6A



Hydraulic Fracturing Drill Site – Western Pennsylvania

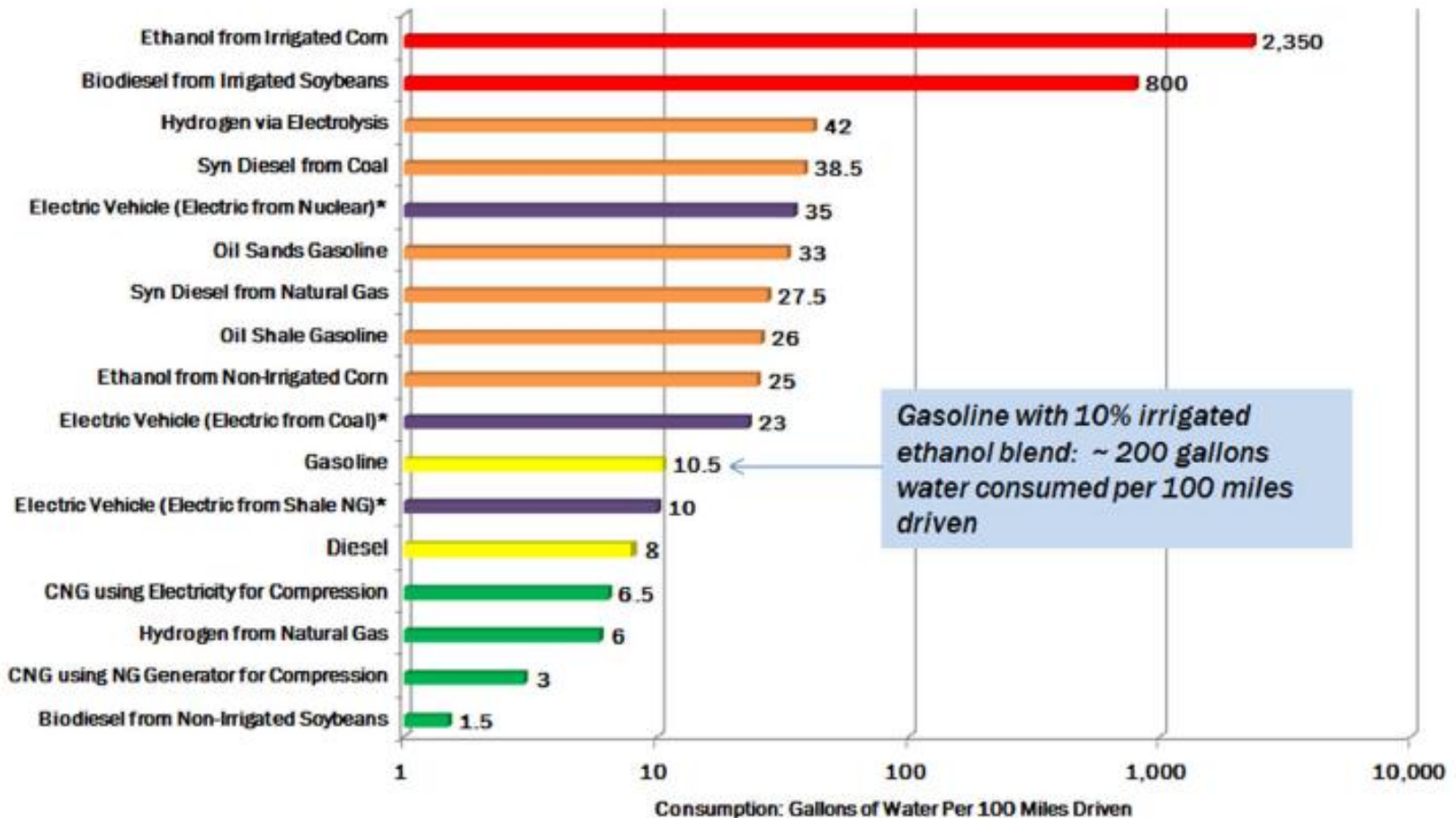


Water Used to Produce Energy



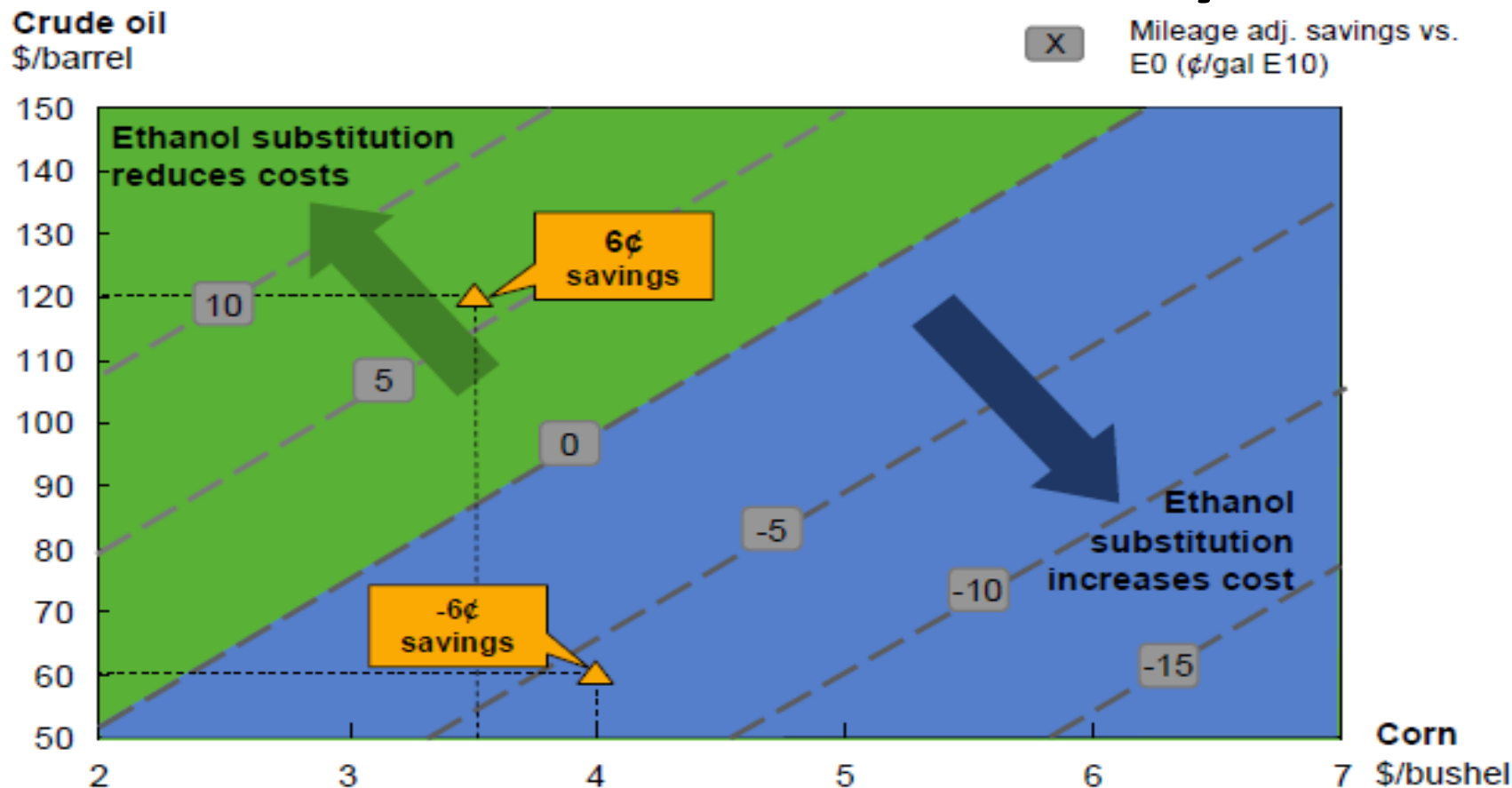
Source: U.S. DOE, Chesapeake

Water Use in Transportation Fuels



Source: U.S. DOE, King and Webber

Ethanol Mandate: A Cautionary Tale



Source: U.S. DOE, National Renewable Energy Laboratory, *The Impact of Ethanol on Gasoline Prices*, November 2008.