Supply and Demand for Natural Gas

Presentation to:
A&D Breakfast
Denver, CO

June 19, 2013
By:
John Harpole

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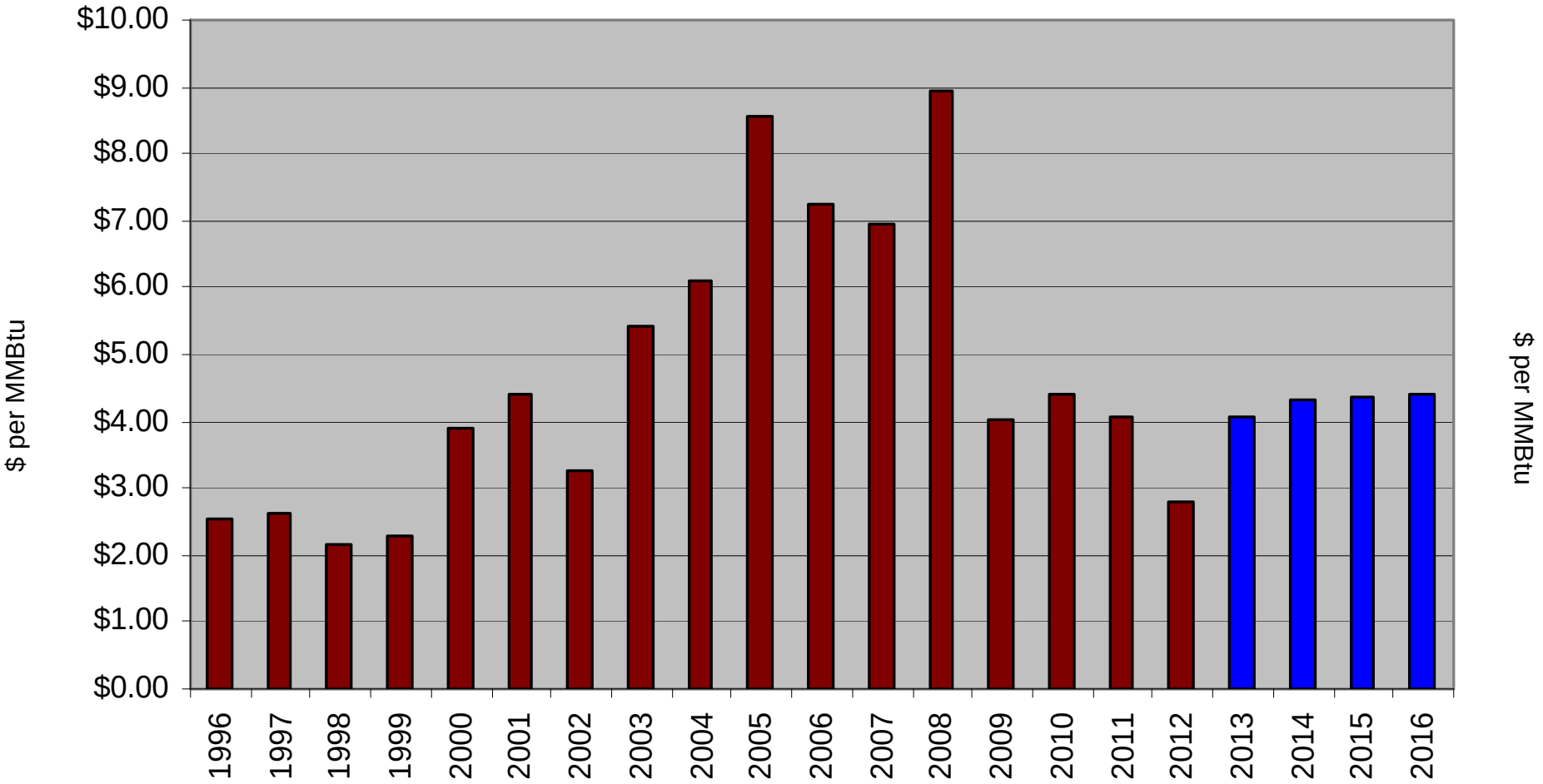
NYMEX Henry Hub Natural Gas Price*
1996 - 2016 Actual/Forecast**



Source: *Average of last three days of trading as published in the Platts Gas Daily Report

** Future forecasts based on NYMEX Henry Hub indices in Clearport Software as of 4/30/2013

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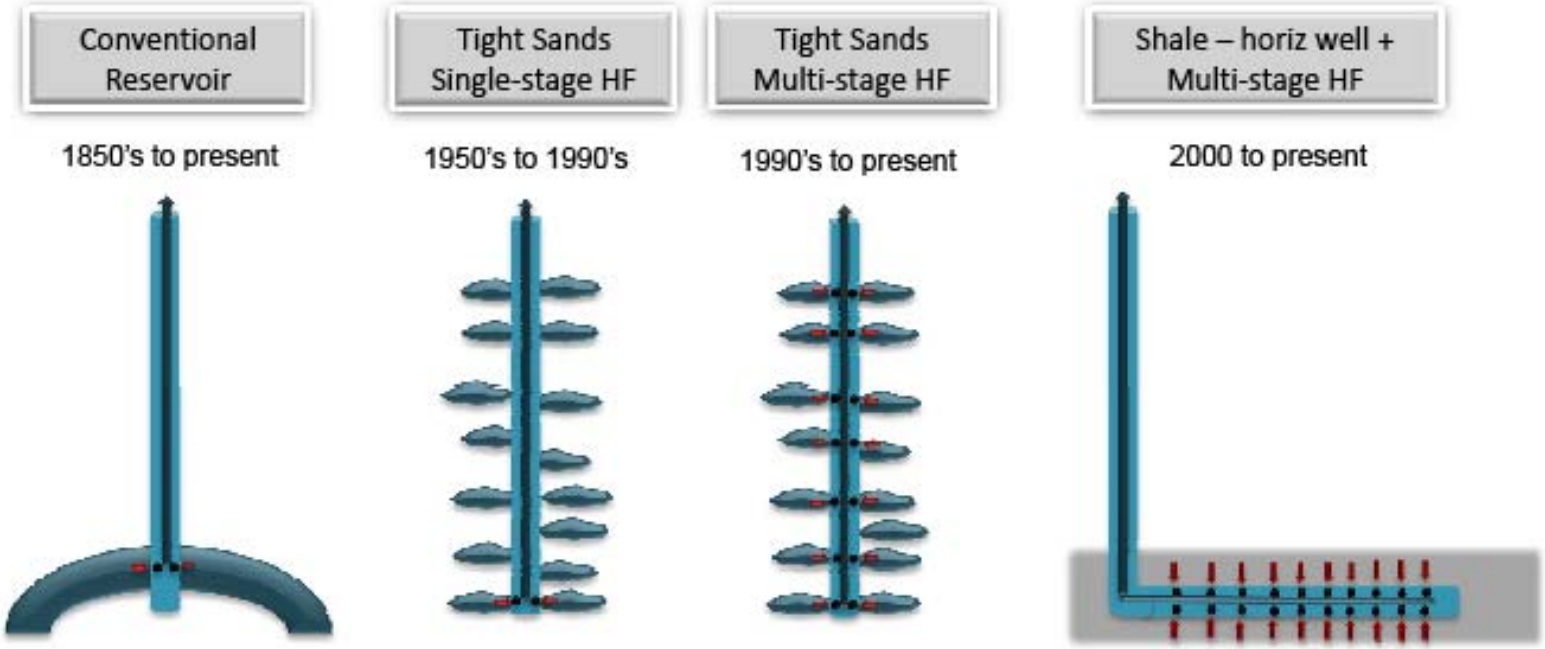
AMERICA'S NATURAL GAS ALLIANCE

EVOLUTION IN GAS WELL COMPLETEION TECHNOLOGY - THE KEY TO TODAY'S NATURAL GAS REVOLUTION



Multi-stage hydraulic fracture stimulation (HF) unlocks gas in unconventional reservoirs

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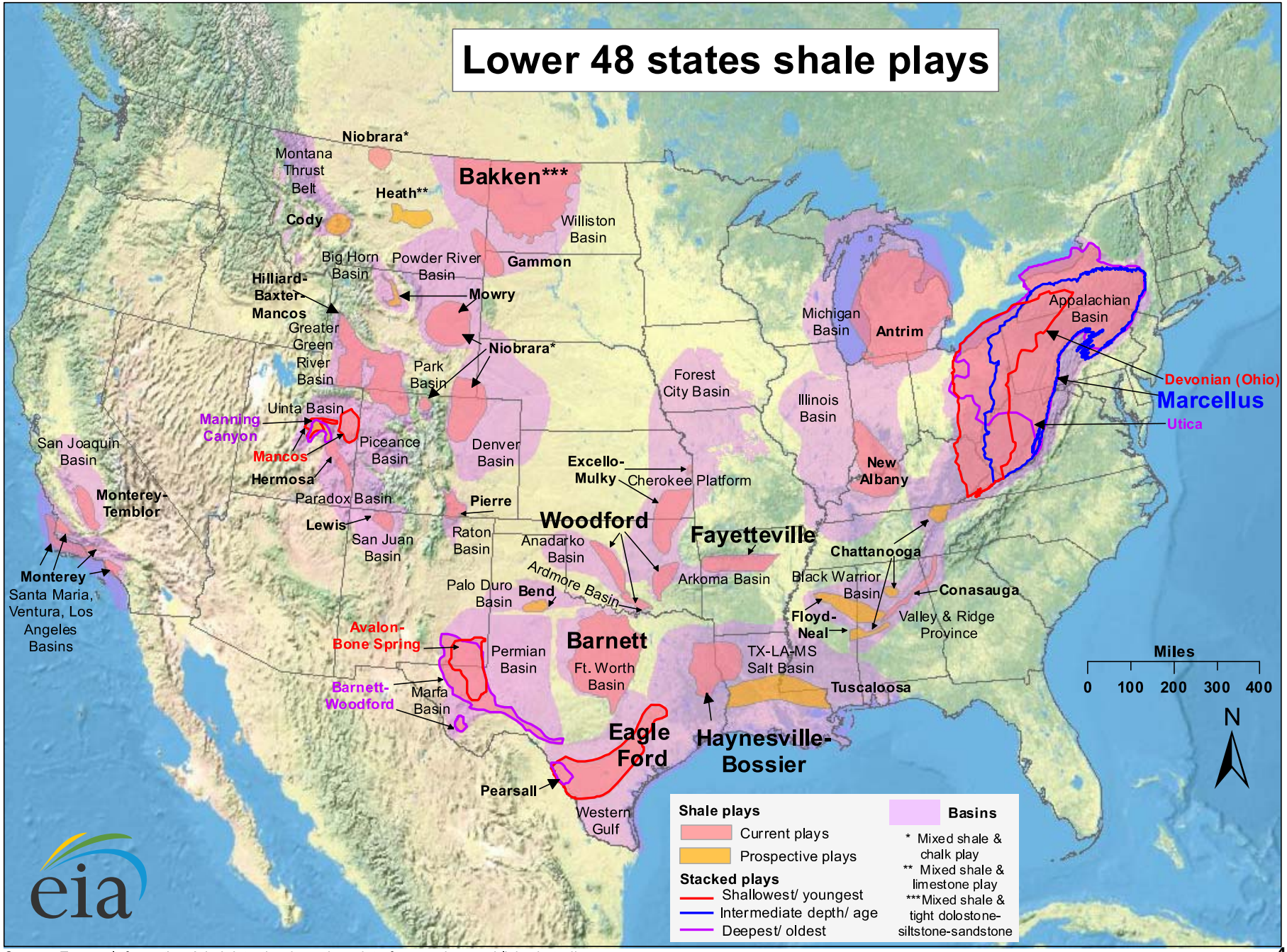
Source: *America's New Natural Gas,* America's Natural Gas Alliance



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

THE SUPPLY CURVE HAS MOVED

According to the Potential Gas Committee, during the last two years, the future gas supply estimate for the US rose nearly 25% to a 48-year record of 2,688 TCF.

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Forecasts for Shale Gas Resource?

- 2008 - 347 TCF - Energy Information Administration (EIA)
- 2008 - 840 TCF - Navigant for Clean Skies Foundation
- 2009 - 616 TCF - Potential Gas Committee (PGC)
- 2011 - 827 TCF - Energy Information Administration (EIA)
- 2013 – 1,073 TCF - Potential Gas Committee (PGC)

Source: Various resource estimates

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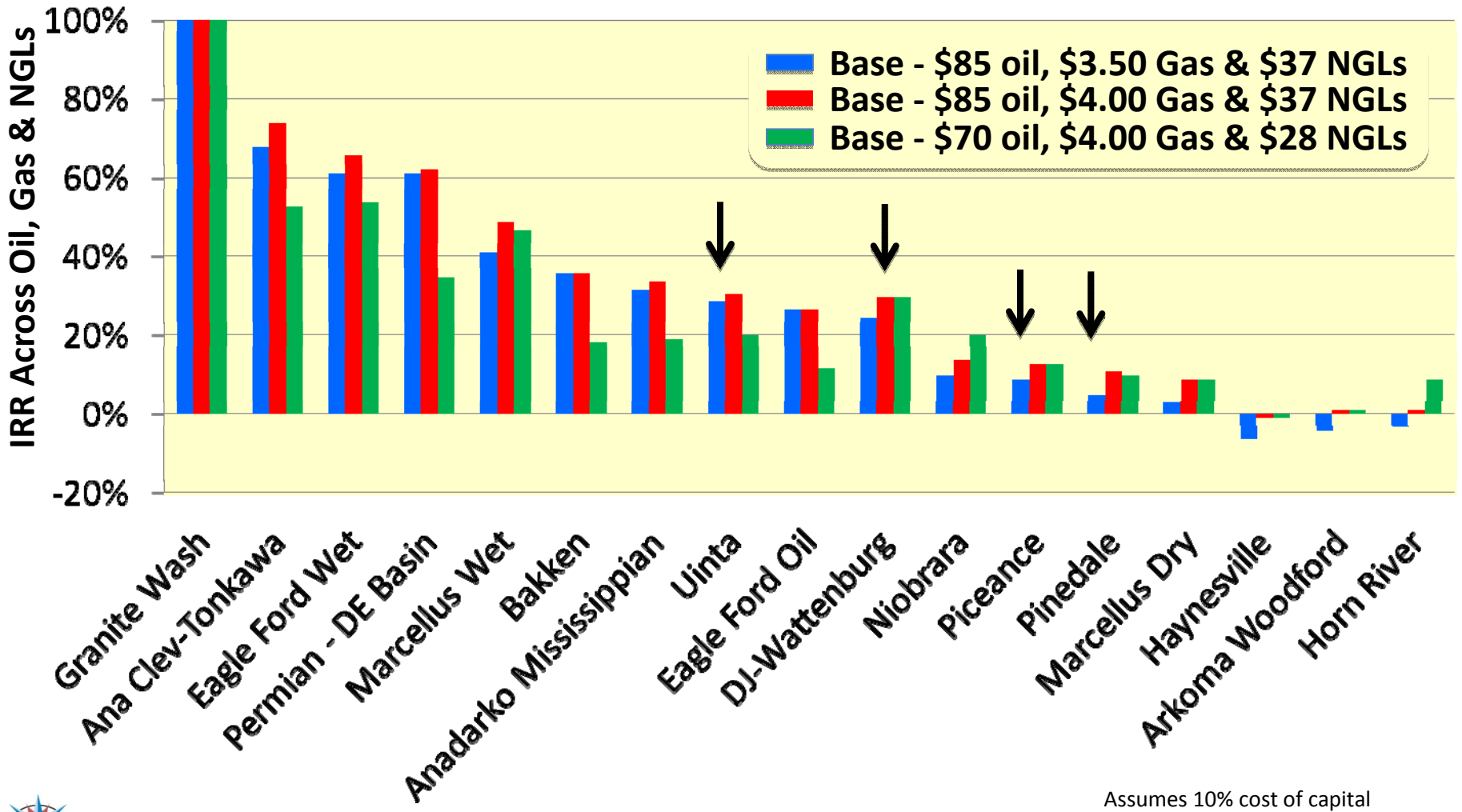
Much Of The U.S. Is Economical Even With $70 Oil



Assumes 10% cost of capital

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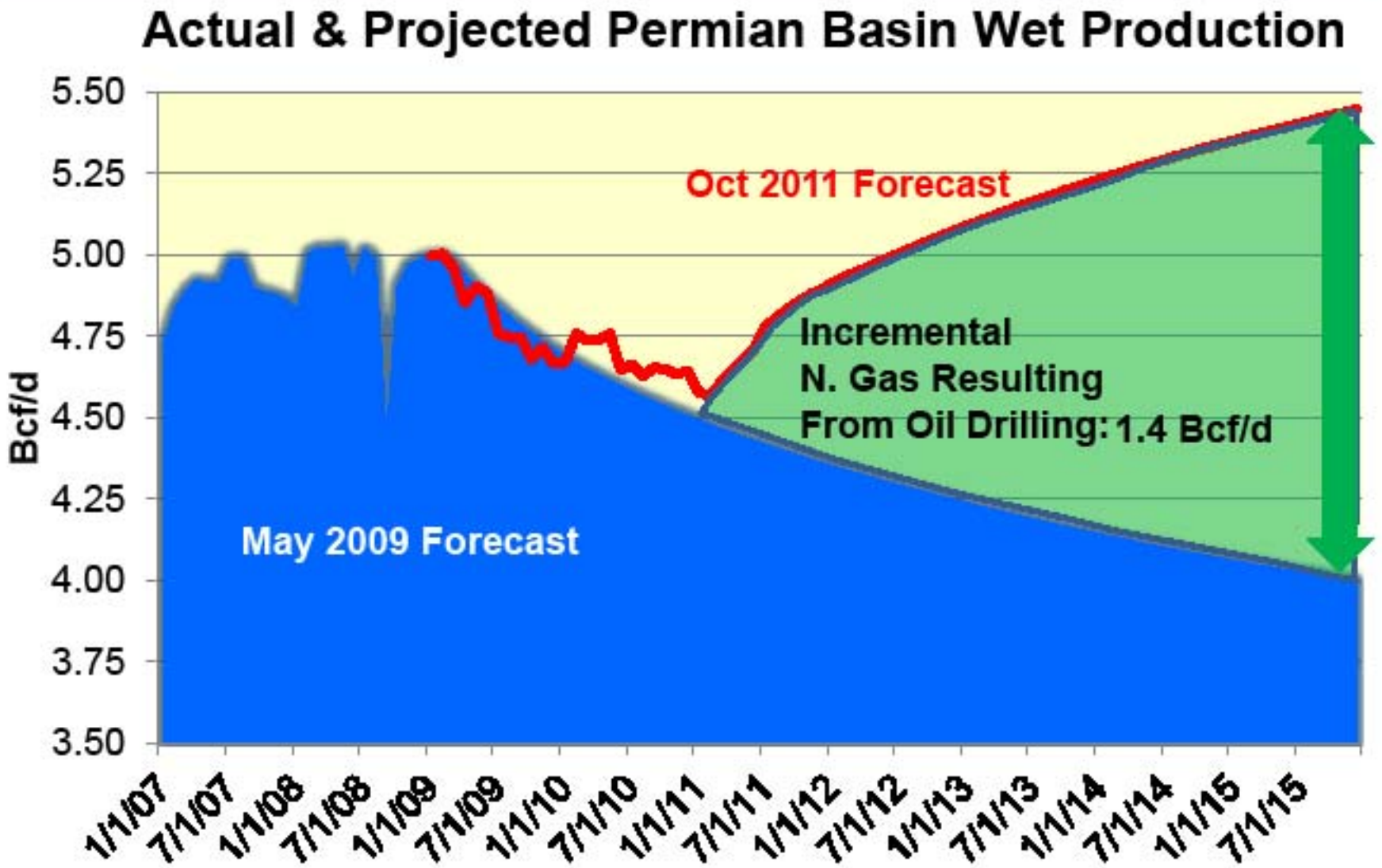
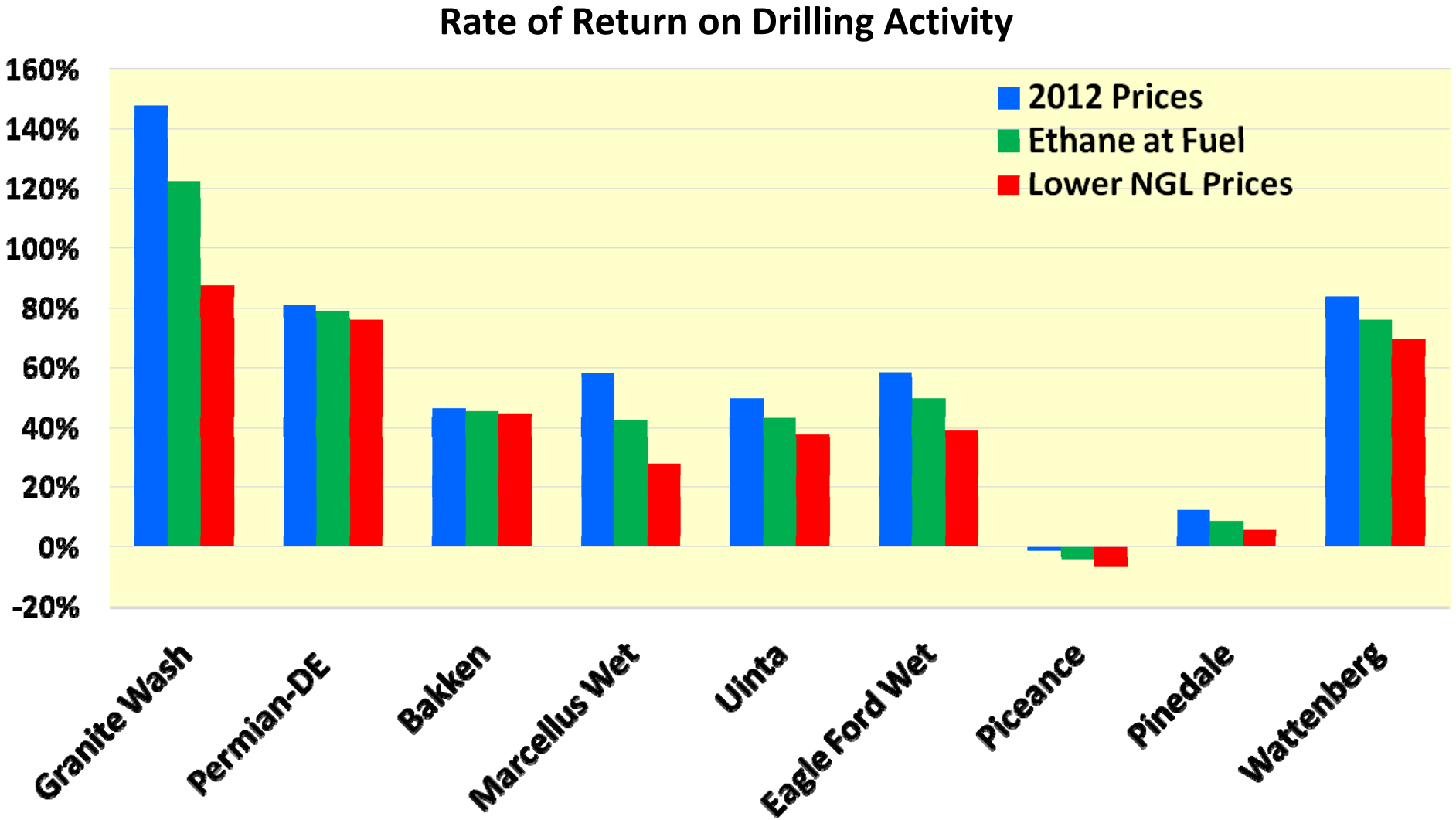
Source: Ponderosa Advisors LLC

Ironically, Oil & Liquids Exploration Drives Gas Production

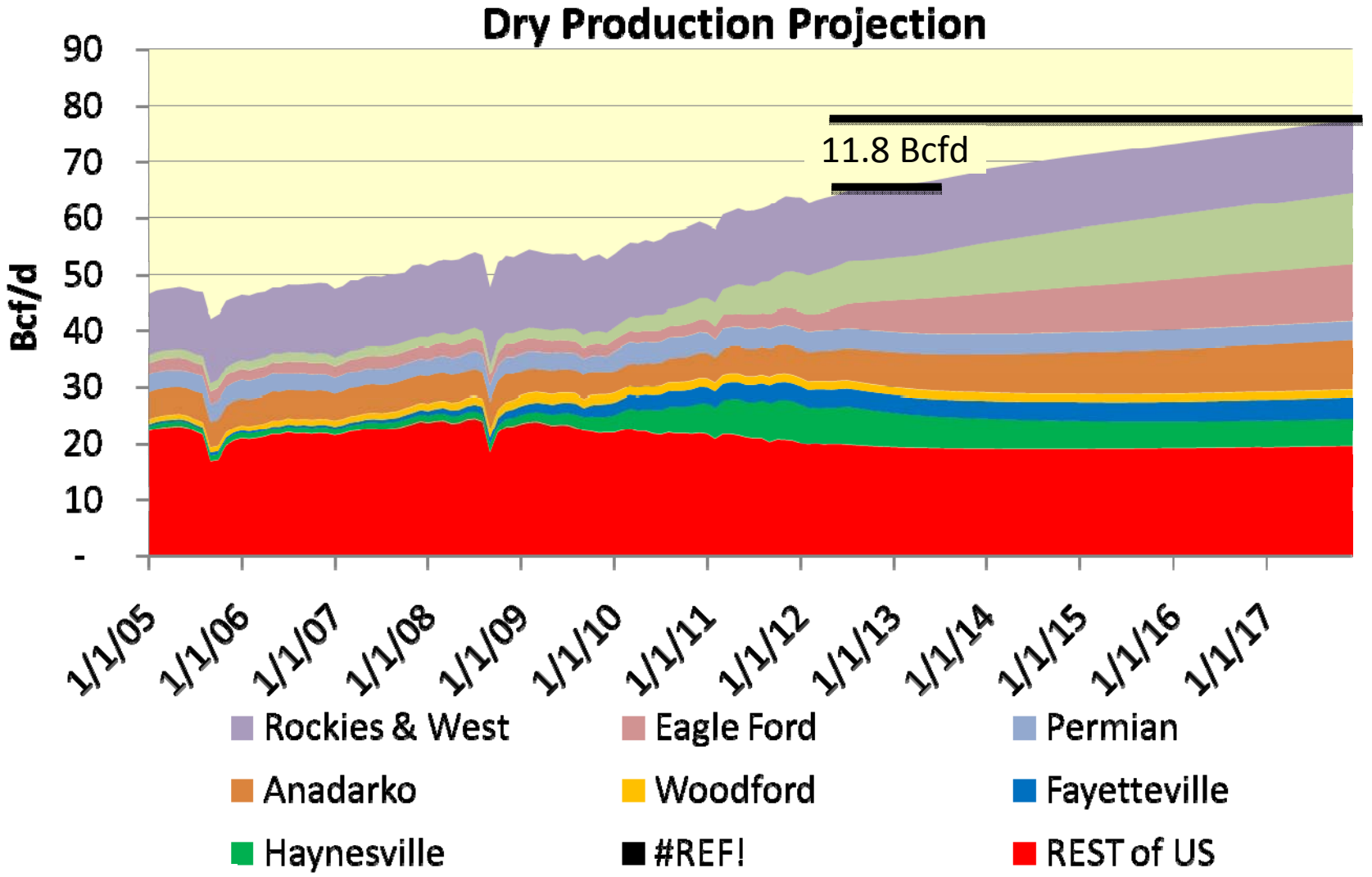


Falling NGL Prices Have Minimal Impacts In Liquids Rich Areas



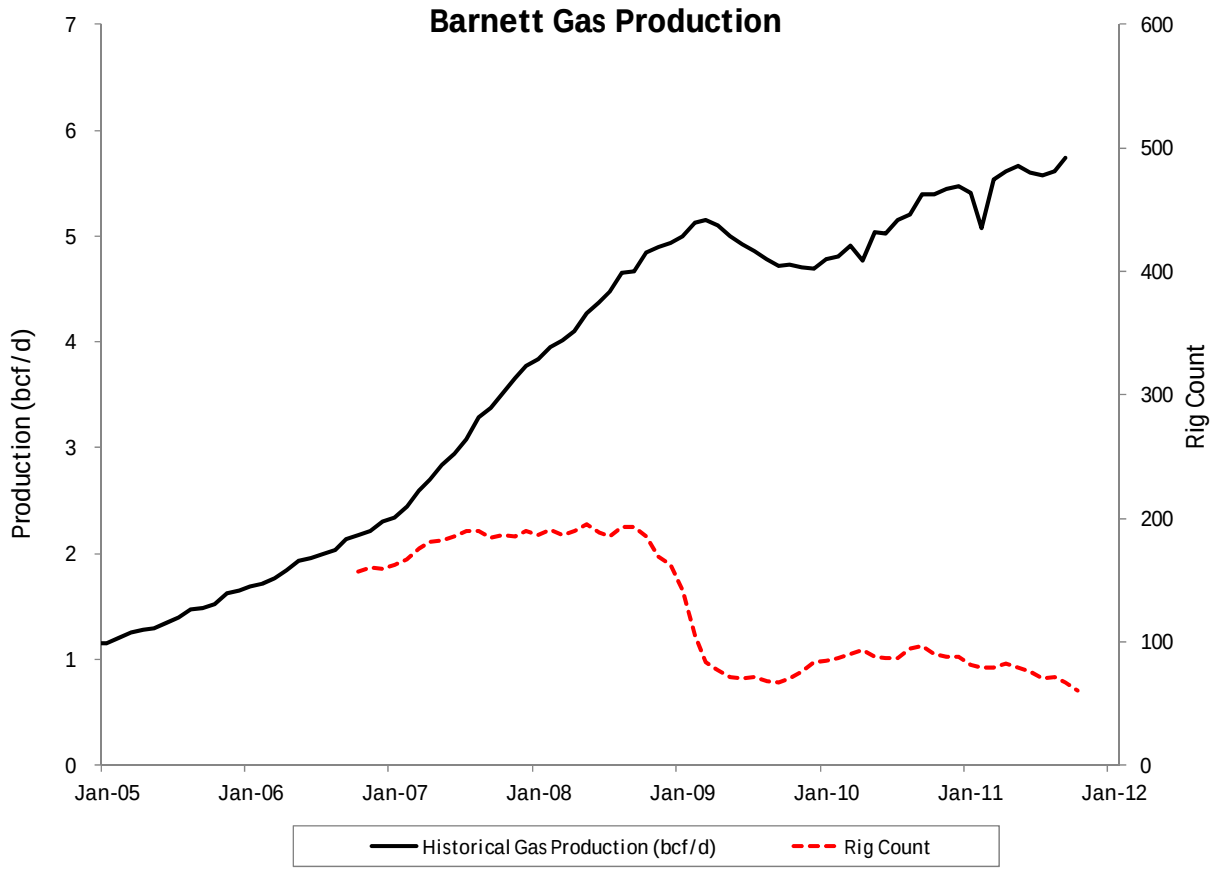
Source: Ponderosa Advisors LLC

Dry Natural Gas Production Is Expected To Grow



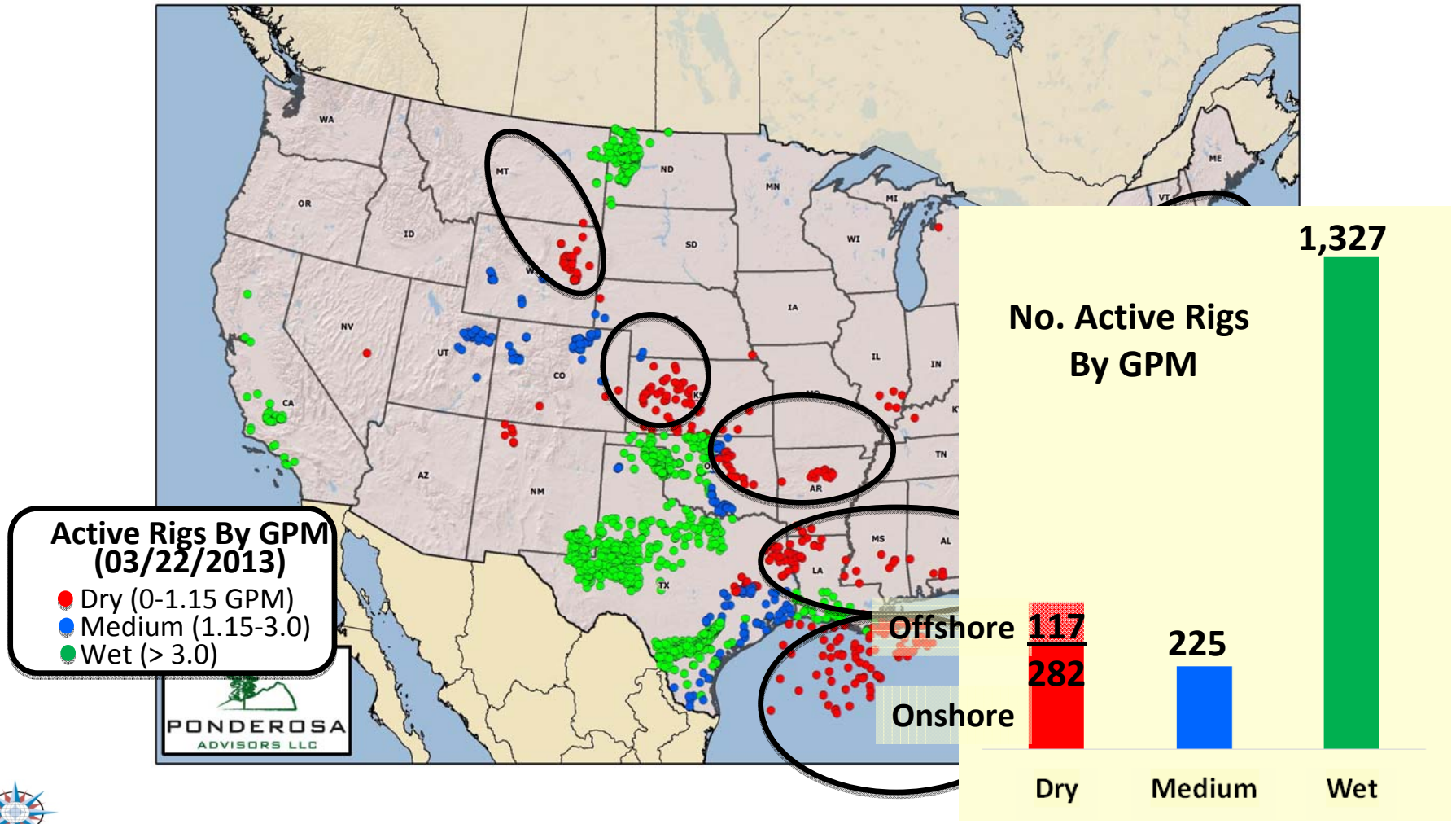
Source: Ponderosa Advisors LLC

Barnett – Model for Future Shale Development



Source: HPDI, RigData, TPH Estimates
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

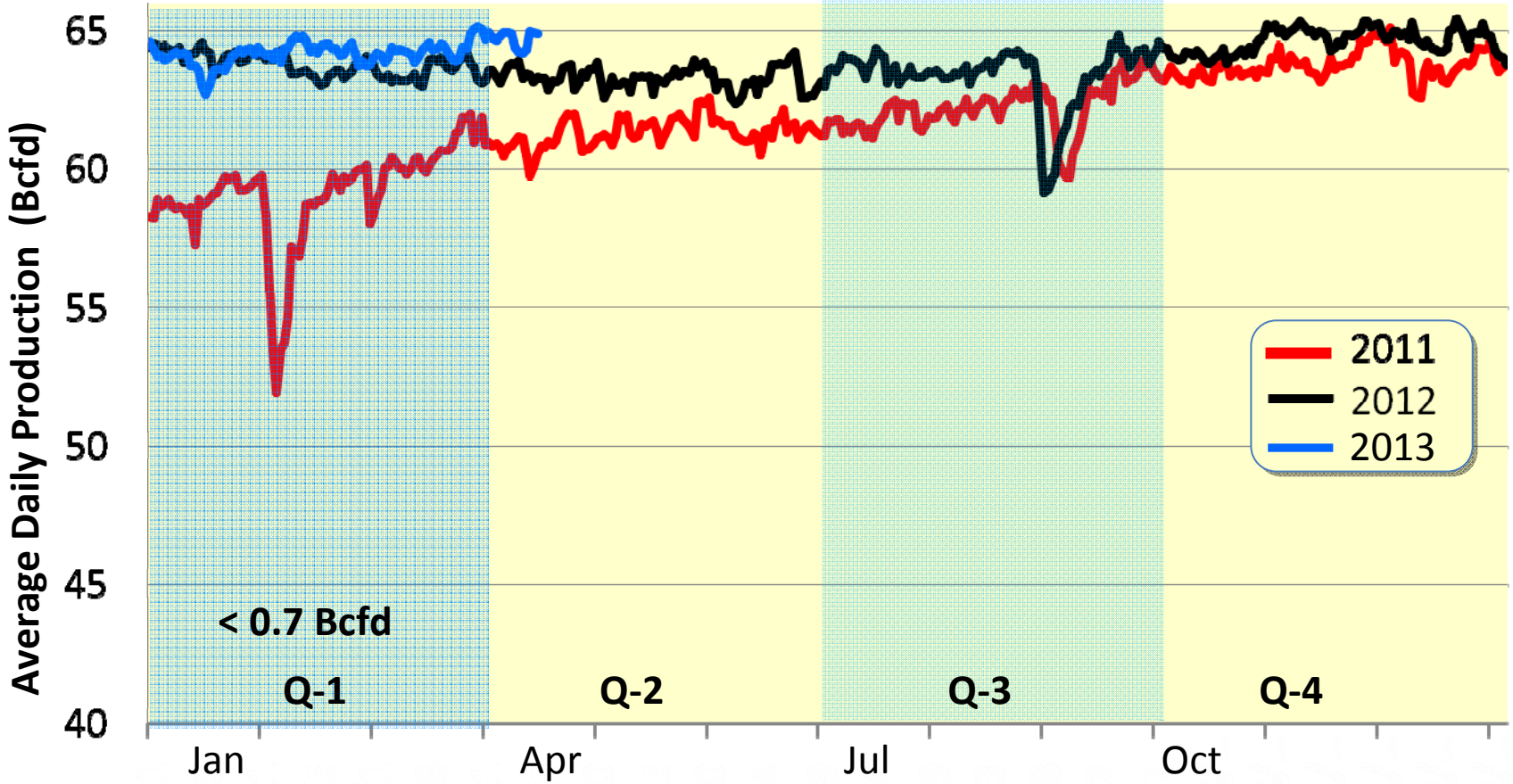
15% Onshore Active Rigs Are Working In Dry Gas Areas



Source: Ponderosa Advisors LLC

US Production Is Up From 2012 By Almost 400 MMcfd

Comparison of Dry Production



Data through January 18, 2013

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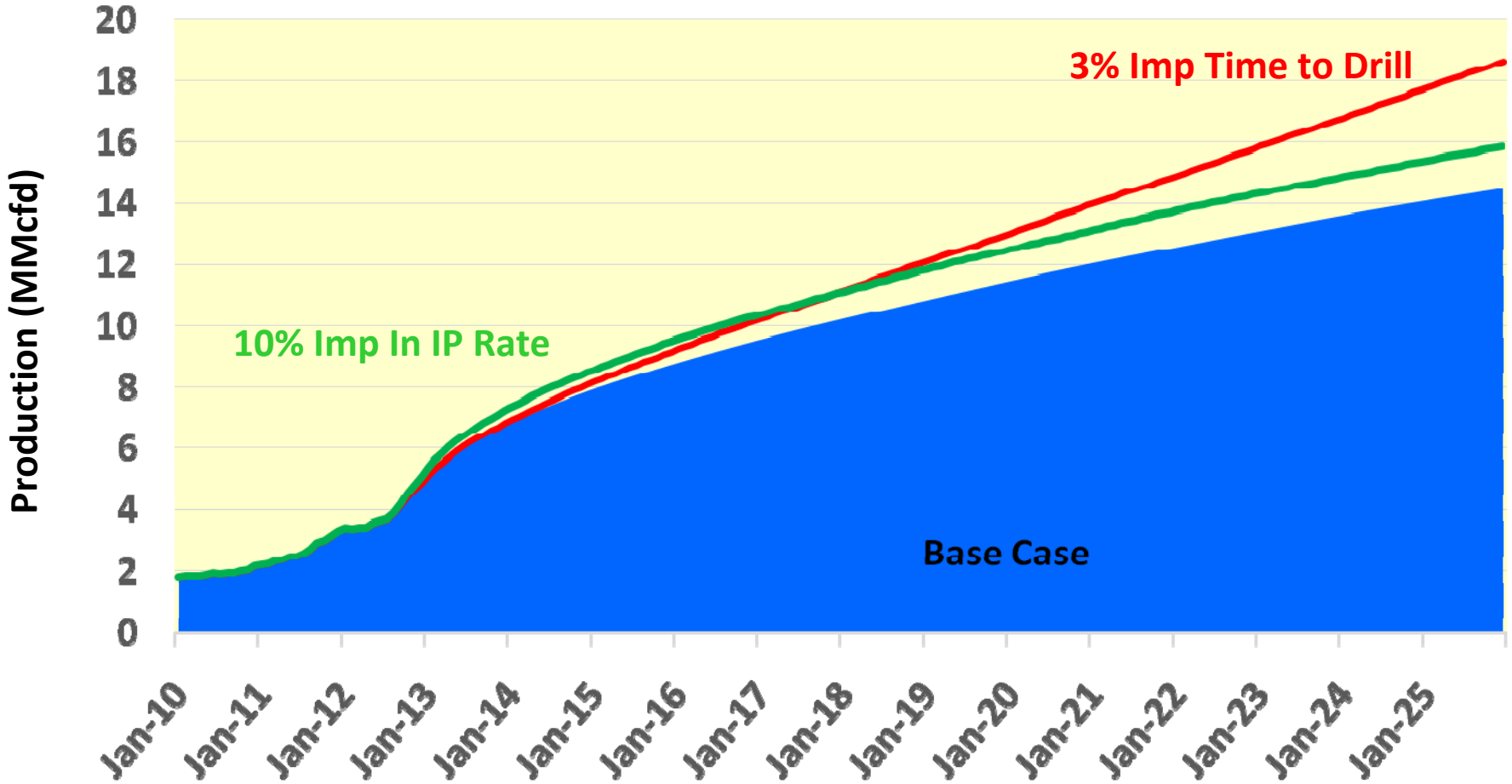
Source: Ponderosa Advisors LLC

Faster Drilling Times Yield More Wells, More Production



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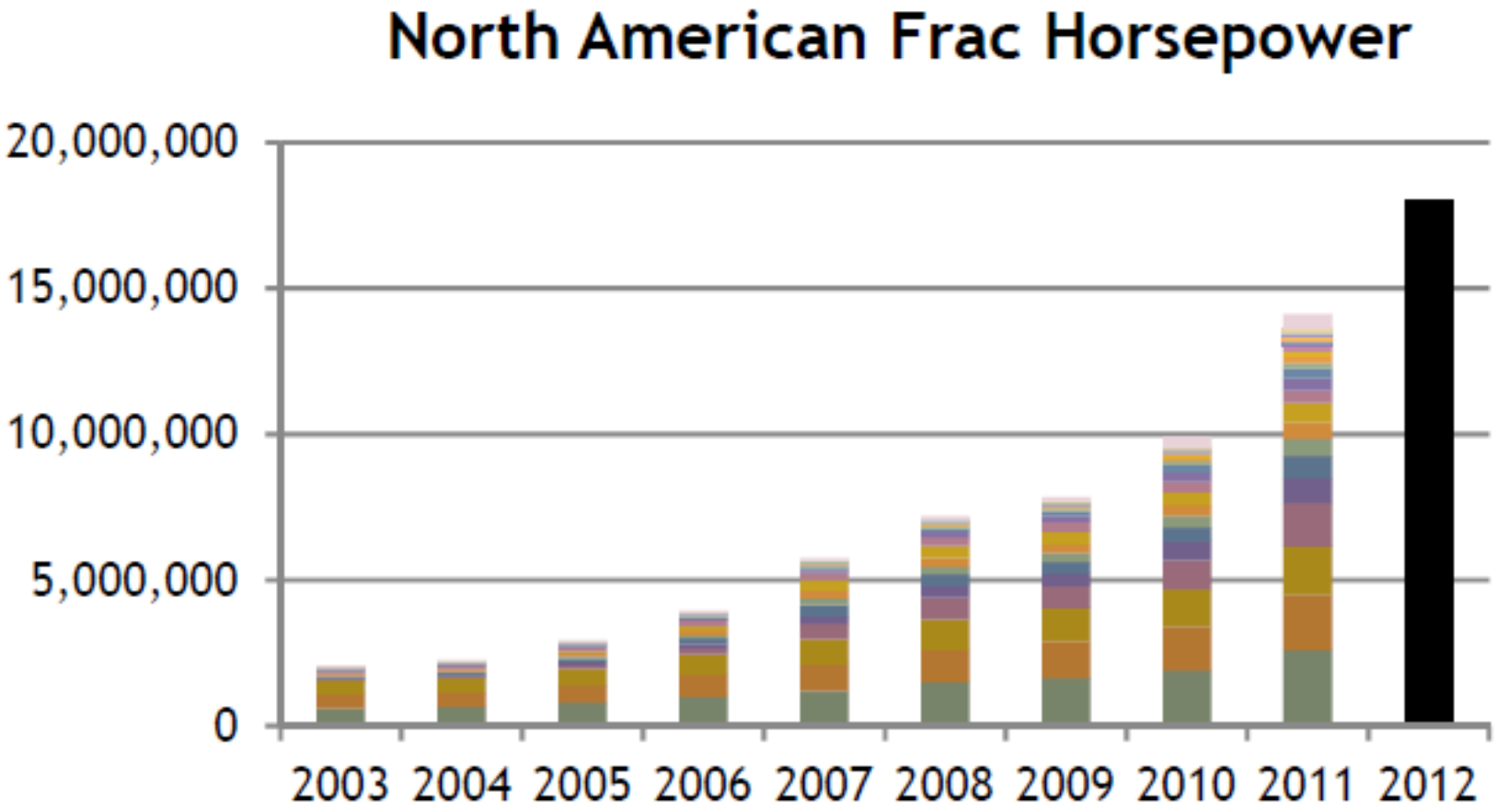
Source: Ponderosa Advisors LLC

Fracturing Application Exploded



Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13

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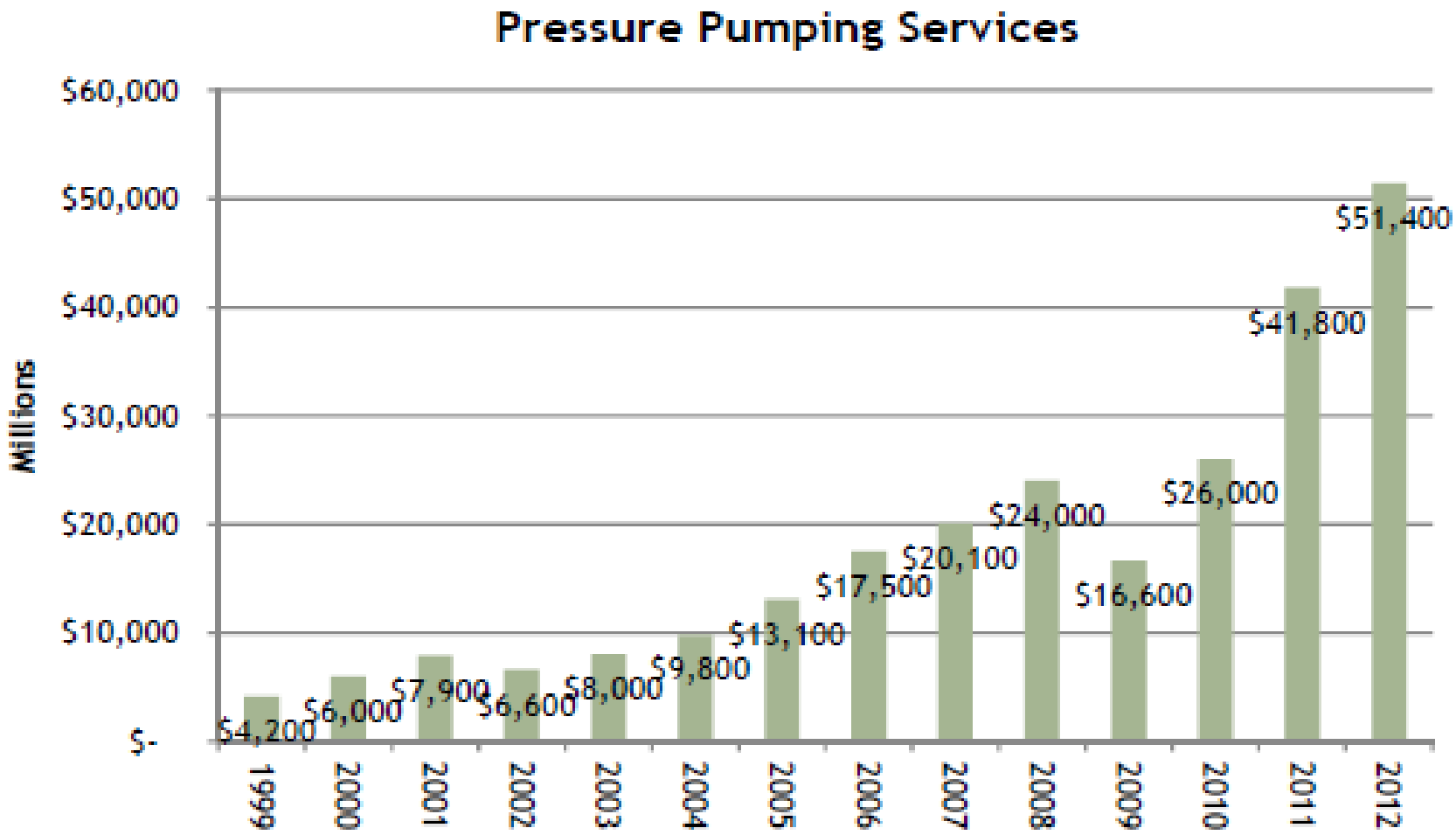
10-fold growth in 10 years



Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13

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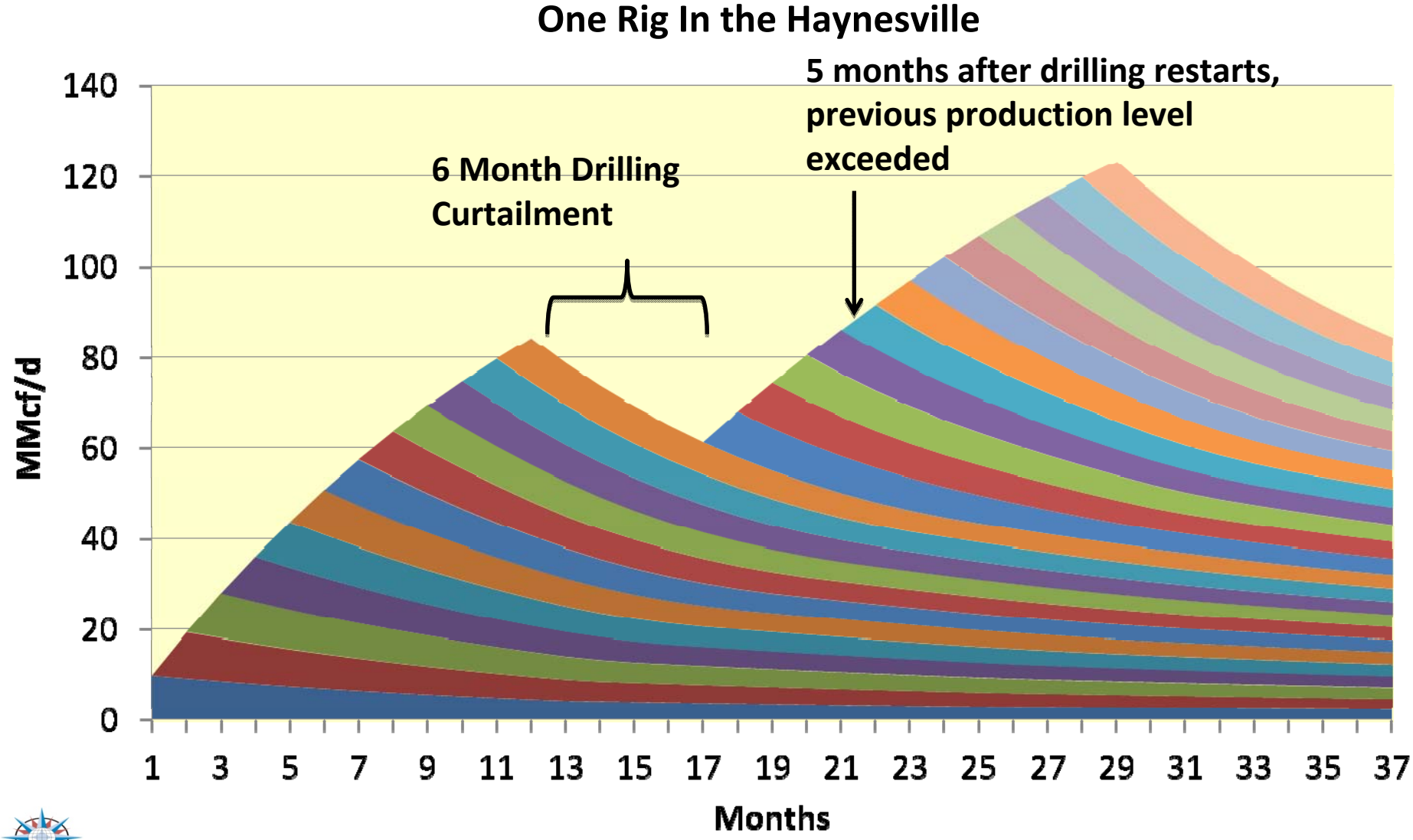
The "Ferrari" Affect Substantially Reduces The Likelihood Of Price Spikes



Source: Ponderosa Advisors LLC

Will the Demand Side Curve Move?

"There is no opportunity for which we can't overcompensate."

Four areas to consider:

1. CNG/NGV vehicle demand
2. Coal to gas electric gen conversion
3. New industrial demand
4. LNG Exports

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1. CNG/Natural Gas Vehicles

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How Many NGVs to Get to 1 BCF Per Day of Demand?

- "The U.S. currently has about 110,000 NGVs on the road (less than 0.1% of total U.S. vehicles), mostly owned by fleets."
- "To get to 1 BCF per day would mean a roughly ten-fold increase in the number of U.S. NGVs."
- It will take the right incentives and plenty of time.
- Let's be aggressive and say 1 BCF per day of demand by 2020.

Source: Raymond James & Associates, Inc., Weekly Energy Report 6-13-11

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2. Coal to Gas Electric Generation Fuel Switching

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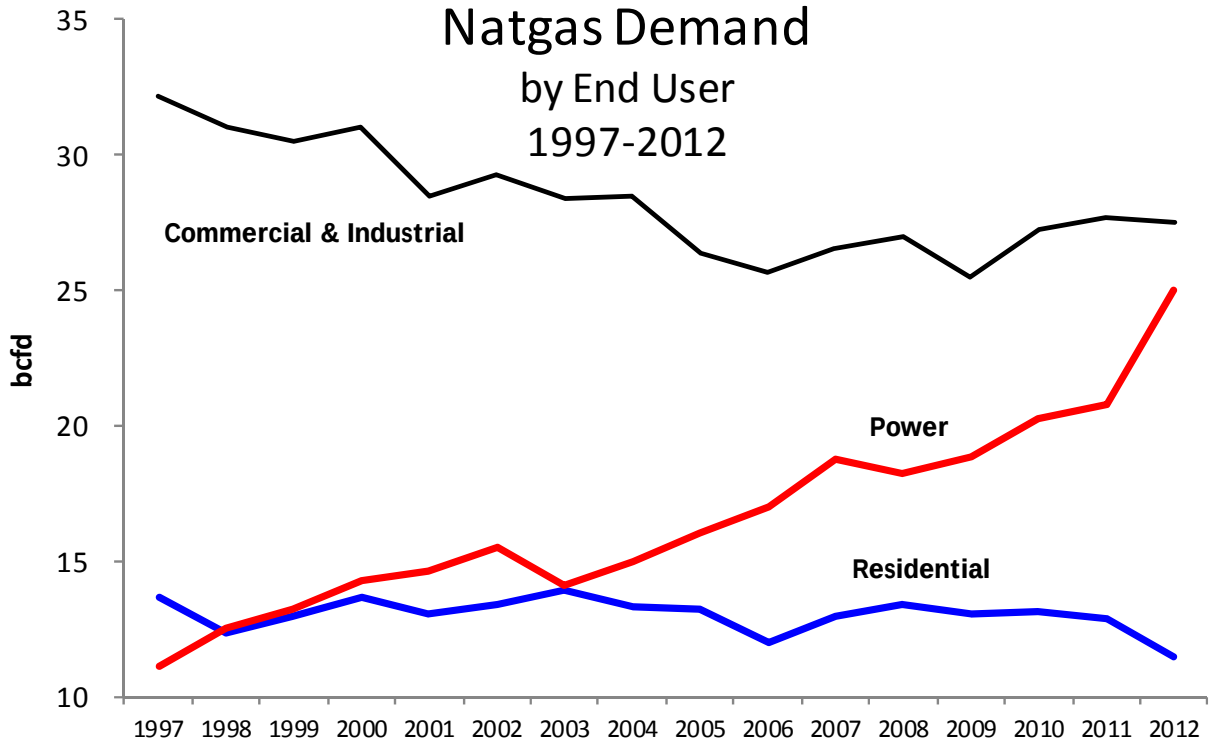
Why Care About Power Generation?

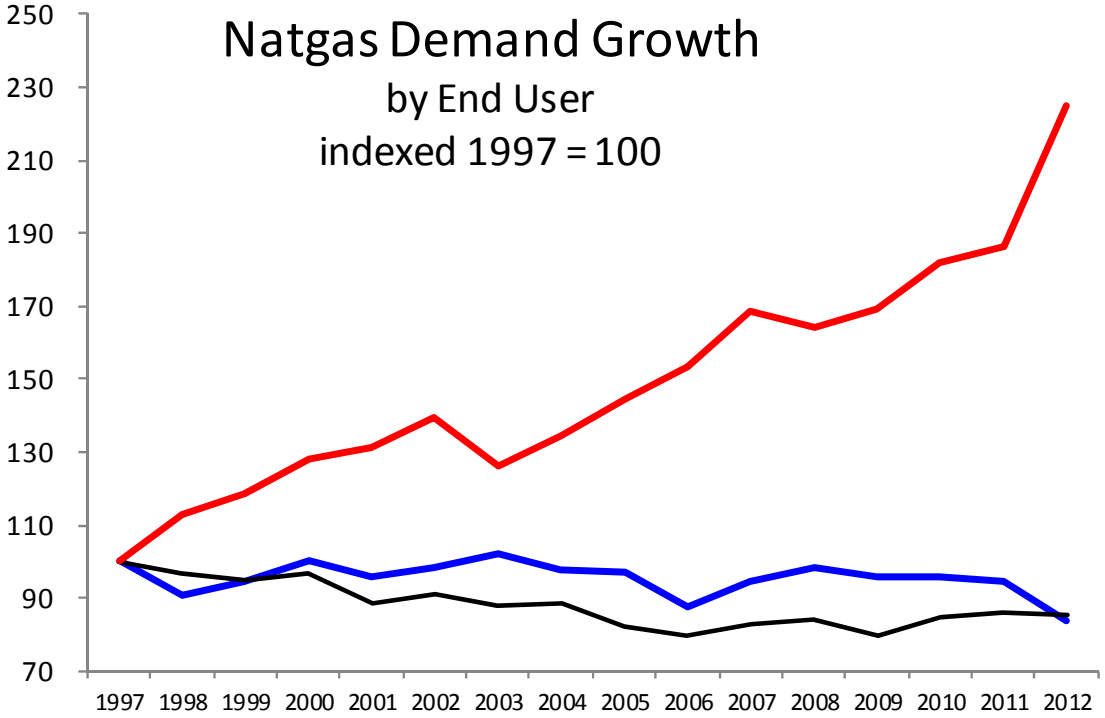
- Power demand historically 20-33% of total US natural gas demand
- Grew to 39% in 2012
- Impressive but power's relative growth even more dramatic



Source: EIA
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

Why Care About Power Generation?

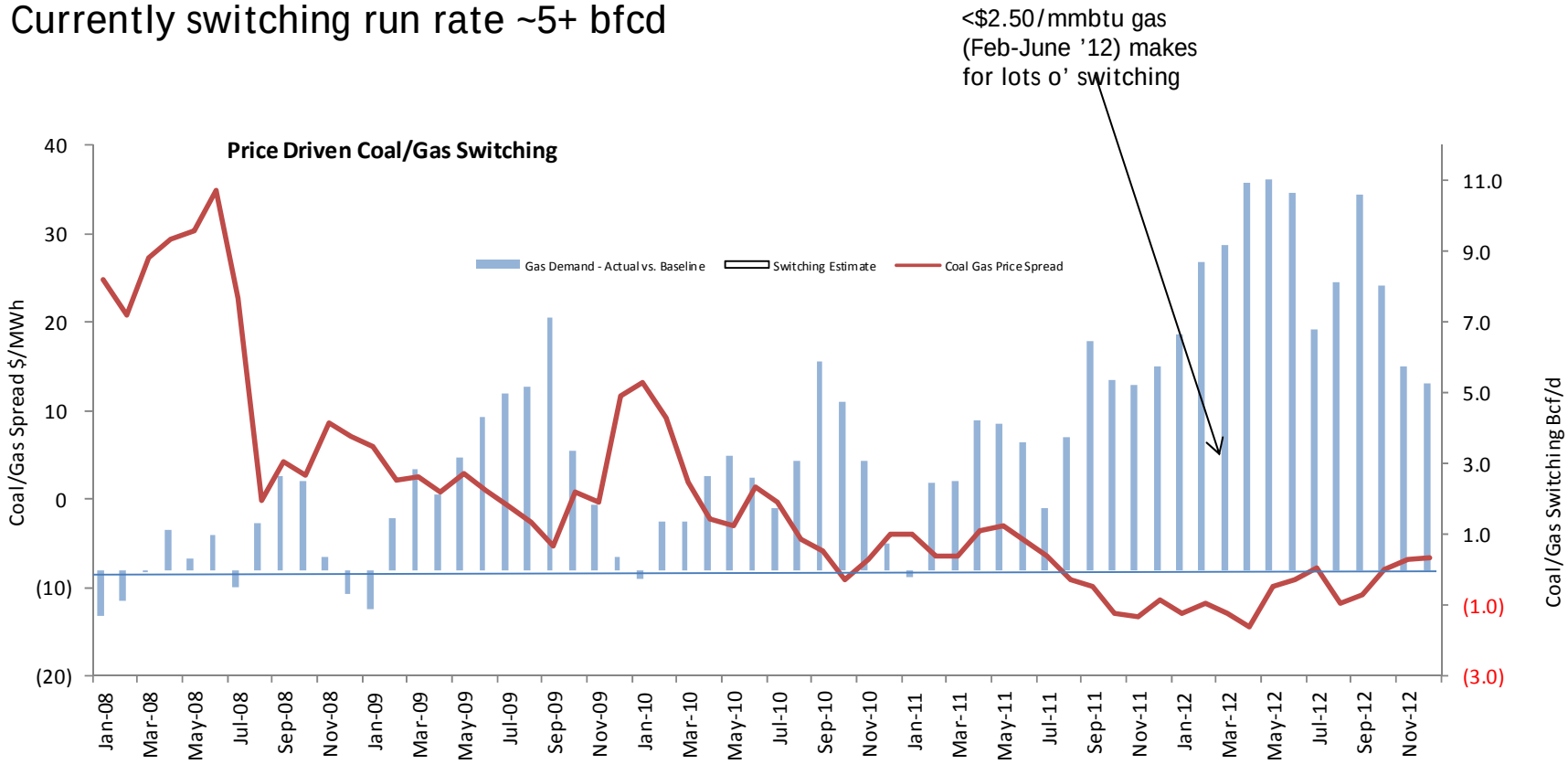
- FY 2012 power gen gas demand increased 21% y/y with total power consumption down -2% y/y
- From 1997 to 2012 power gen gas demand grew 2.25x from 11 bcfd to 25 bcfd
- Impressively demand peaked July 2012 at 36 bcfd



Source: EIA
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

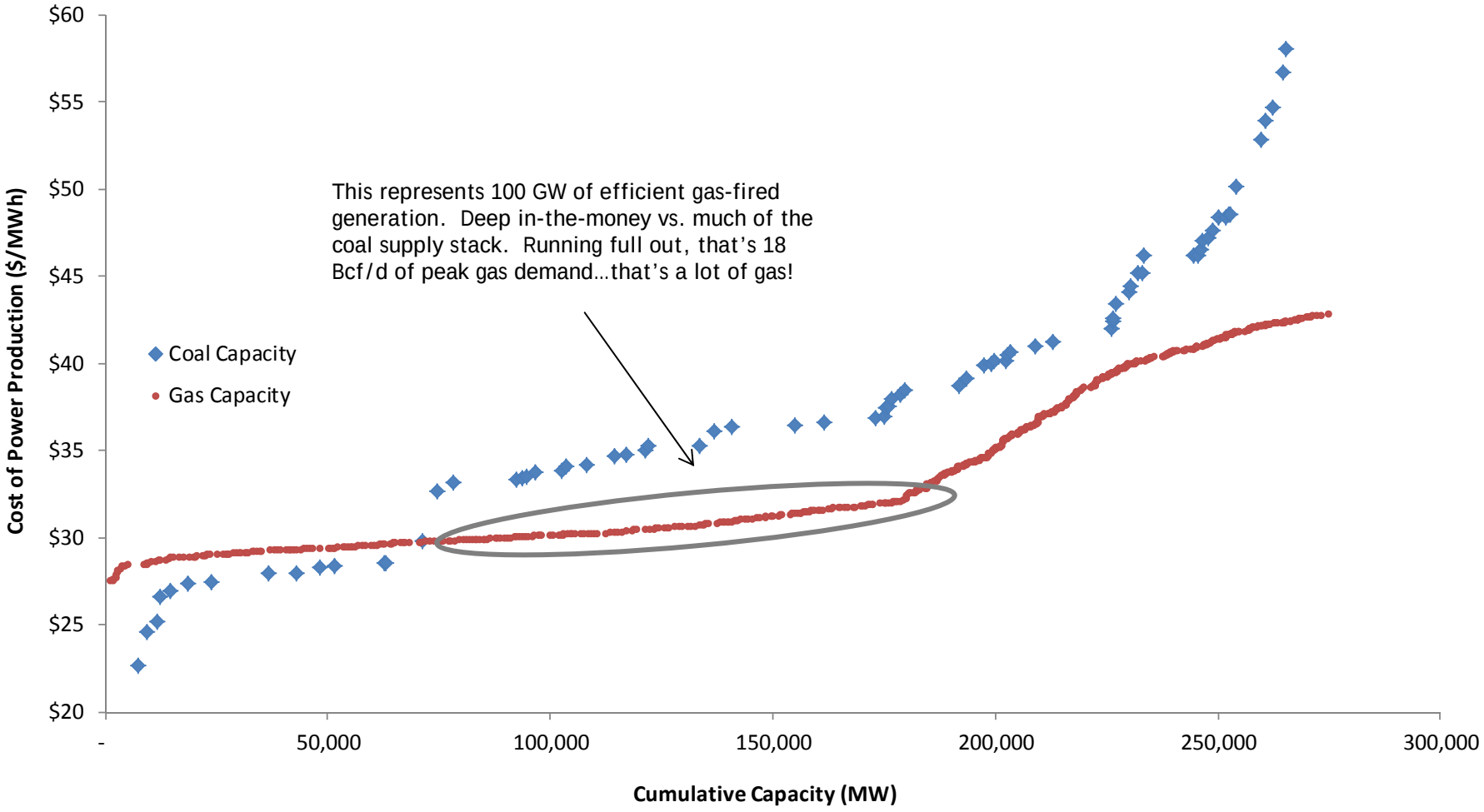
Coal/Gas Switching Price Driven

- FY 2102 Natgas gained an average 8.5 bcfd of power generation market share
- 2012 Switching strong but shy of our 12 bcfd "theoretical" ceiling @ $4/mmbtu gas… got close (Feb-June 2012) but required <$2.50/mmbtu gas
- Currently switching run rate ~5+ bfcd



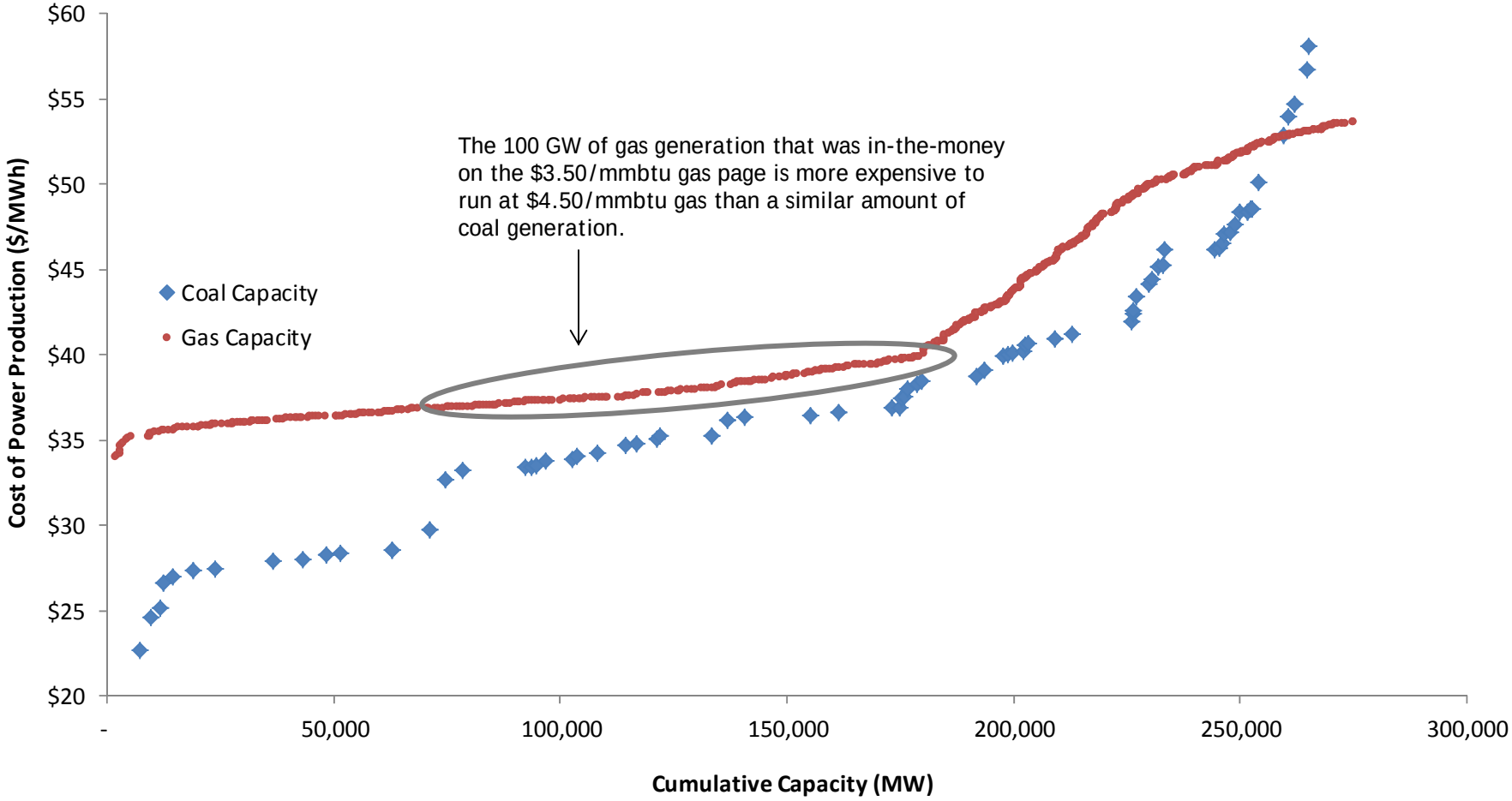
Source: EIA, TPH Research
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

Generation Supply Stack - $3.50 Natural Gas Price Deck



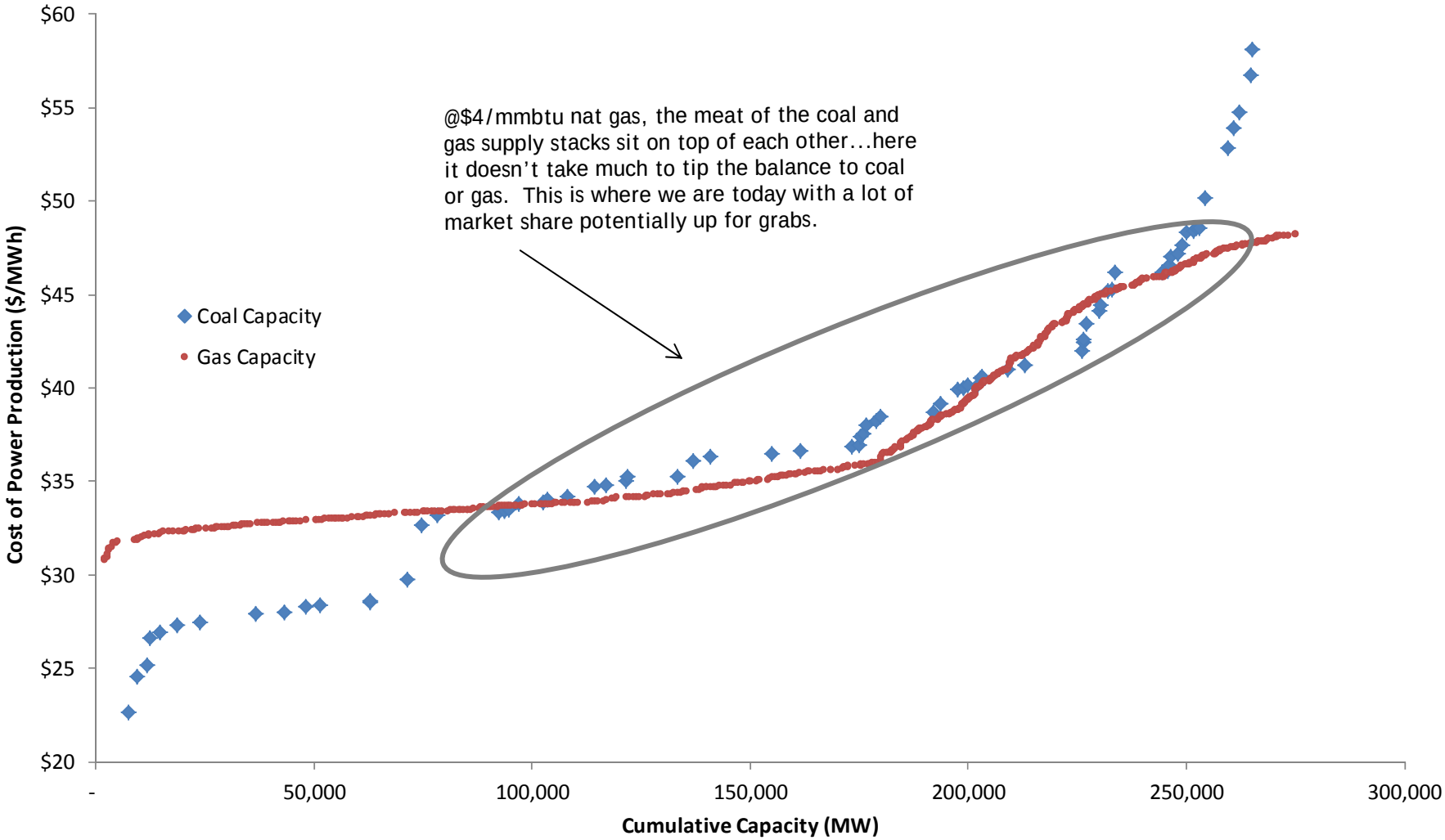
Source: TPHe, EIA, SNL Energy
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

Generation Supply Stack - $4.50 Natural Gas Price Deck



Source: TPHe, EIA, SNL Energy
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

Generation Supply Stack - $4.00 Natural Gas Price Deck



Source: TPHe, EIA, SNL Energy
Dave Pursell, Tudor Pickering Holt & Co., *Macro Natural Gas and Oil Thoughts* presentation, May 2, 2013

3. Industrial Demand Growth
(Chemical, Manufacturing, Ethane Crackers, etc.)

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The Ammonia Story

- Current approximate economics
  - Ammonia worth $600 per ton in world market
  - Can be produced for $180 per ton at current U.S NYMEX natural gas price strip
- 14 Ammonia plants closed in the U.S. between 1998 and 2006 thanks in part to high natural gas prices
- Top 5 world producers would like to build new facilities in the U.S.
- 1 ammonia plant can consume as much as 100,000 MMBtu per day

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Dow Exec Sees 90 Manufacturing Projects Planned Using 7 Bcf/d

- "We believe the increase demand will be seen as early as 2015-2020."*
- Manufacturing industry is concerned about "the undisciplined export of liquefied natural gas".
- US manufacturing industry will not support LNG exports

Source: NGI's *Daily* Gas Price Index, October 25, 2012

*George Blitz, Vice President of Dow's Energy and Climate Change Division

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Nucor EnCana – A Creative Solution

- A price protection deal for Nucor Steel
- $3.6 billion 20 year investment in 4,000 wells located in western Colorado
- Lack of counterparty creditworthiness drove the structure of the deal
- A financial investment/partnership in drilling and development was the only solution for Nucor
- Nucor will sell the gas in western Colorado and use the cash to purchase like volumes in Louisiana
- This deal structure allowed for the phased development of a $1.4 billion DRI steel mill
- The EnCana Nucor deal is responsible for all of EnCana's 5 drilling rigs in western Colorado and will eventually increase to 8 rigs

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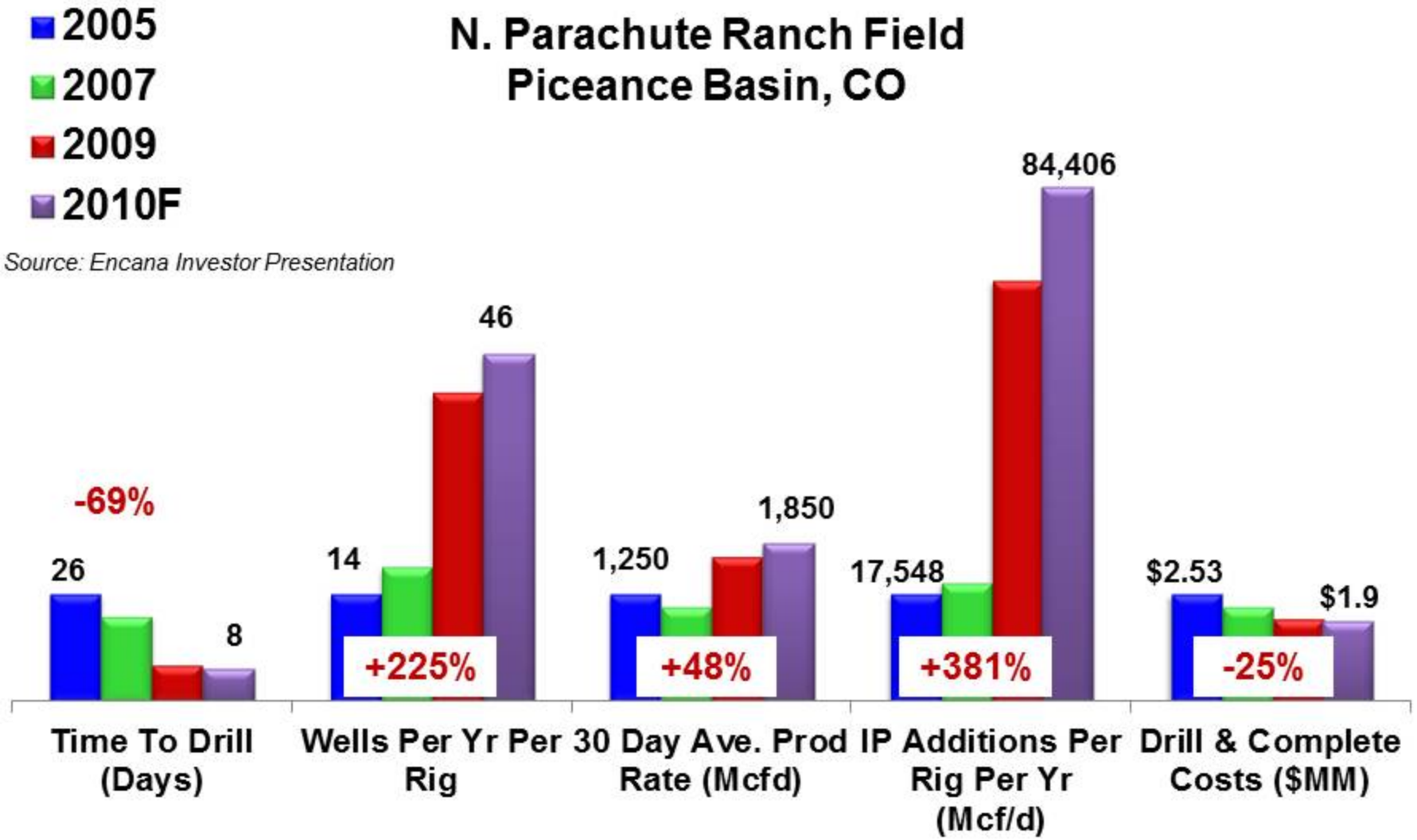
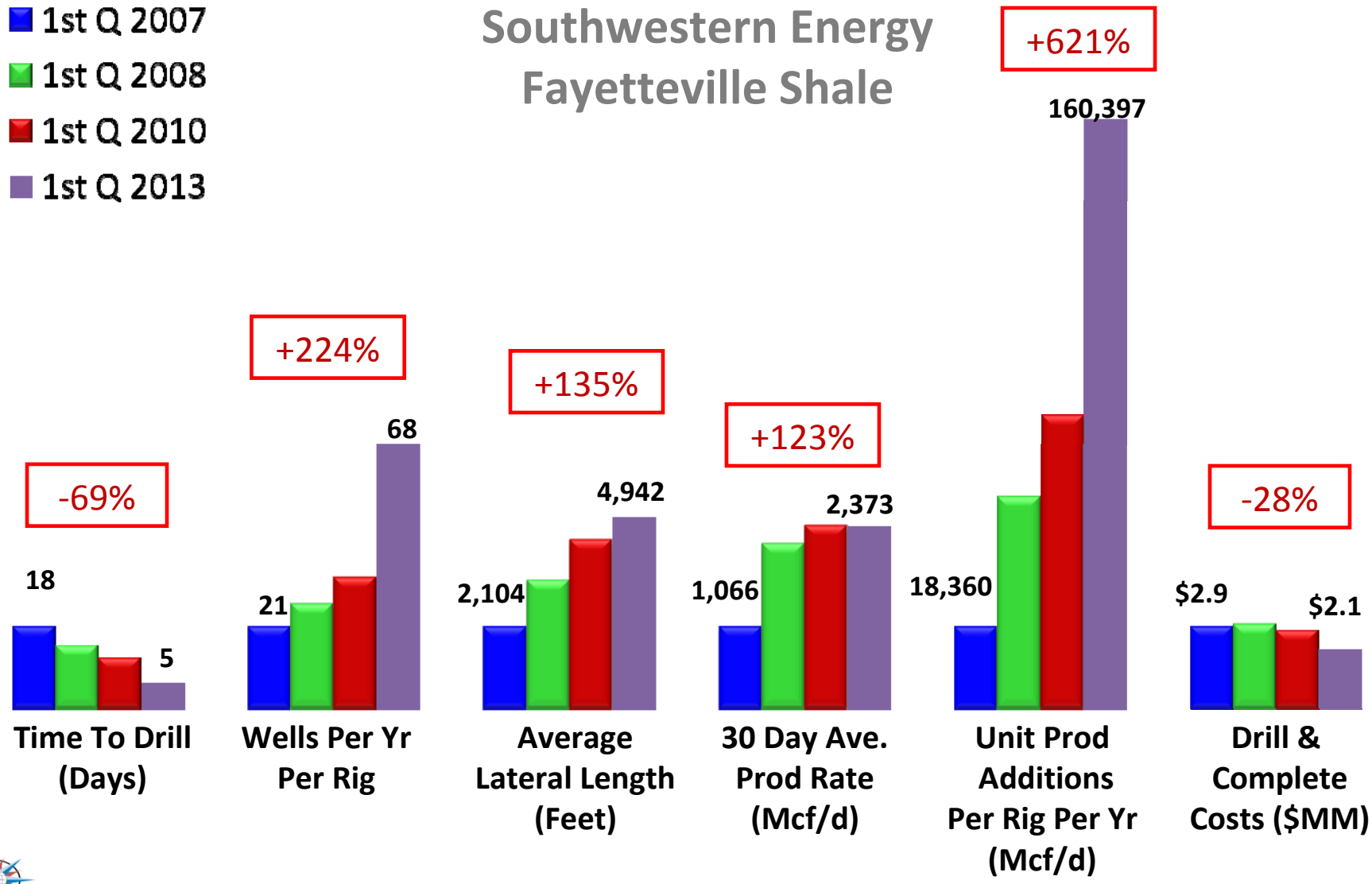
Encana's "Gas Factory" Yields Similar Gains



Drilling Rig Productivity Continues To Improve



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Source: Southwestern Energy Financials

4. LNG Exports

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Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of April 2, 2013)

All Changes Since March 7, 2013 Update Are In Red

	Company	Quantity [a]	FTA Applications [b] (Docket Number)	Non-FTA Applications [c] (Docket Number)
1	Sabine Pass Liquefaction, LLC	2.2 billion cubic feet per day (Bcf/d) [d]	Approved (10-85-LNG)	Approved (10-111-LNG)
2	Freeport LNG Expansion, L.P. and FLNG Liquefaction, LLC	1.4 Bcf/d [e]	Approved (10-160-LNG)	Under DOE Review (10-161-LNG)
3	Lake Charles Exports, LLC	2.0 Bcf/d [m]**	Approved (11-59-LNG)	Under DOE Review (11-59-LNG)
4	Carib Energy (USA) LLC	0.03 Bcf/d: FTA 0.01 Bcf/d: non-FTA [f]	Approved (11-71-LNG)	Under DOE Review (11-141-LNG)
5	Dominion Cove Point LNG, LP	1.0 Bcf/d [g]	Approved (11-115-LNG)	Under DOE Review (11-128-LNG)
6	Jordan Cove Energy Project, L.P.	1.2 Bcf/d: FTA 0.8 Bcf/d: non-FTA [g]	Approved (11-127-LNG)	Under DOE Review (12-32-LNG)
7	Cameron LNG, LLC	1.7 Bcf/d [g]	Approved (11-145-LNG)	Under DOE Review (11-162-LNG)
8	Freeport LNG Expansion, L.P. and FLNG Liquefaction, LLC [h]	1.4 Bcf/d [g]	Approved (12-06-LNG)	Under DOE Review (11-161-LNG)
9	Gulf Coast LNG Export, LLC [i]	2.8 Bcf/d [d]	Approved (12-05-LNG)	Under DOE Review (12-05-LNG)
10	Gulf LNG Liquefaction Company, LLC	1.5 Bcf/d [d]	Approved (12-47-LNG)	Under DOE Review (12-101-LNG)
11	LNG Development Company, LLC (d/b/a Oregon LNG)	1.25 Bcf/d [d]	Approved (12-48-LNG)	Under DOE Review (12-77-LNG)
12	SB Power Solutions Inc.	0.07 Bcf/d	Approved (12-50-LNG)	n/a
13	Southern LNG Company, L.L.C.	0.5 Bcf/d [d]	Approved (12-54-LNG)	Under DOE Review (12-100-LNG)
14	Excelerate Liquefaction Solutions I, LLC	1.38 Bcf/d [d]	Approved (12-61-LNG)	Under DOE Review (12-146-LNG)
15	Golden Pass Products LLC	2.6 Bcf/d [d]	Approved (12-88 -LNG)	Under DOE Review (12-156-LNG)
16	Cheniere Marketing, LLC	2.1 Bcf/d [d]	Approved (12-99-LNG)	Under DOE Review (12-97-LNG)
17	Main Pass Energy Hub, LLC	3.22 Bcf/d***	Approved (12-114-LNG)	n/a
18	CE FLNG, LLC	1.07 Bcf/d [d]	Approved (12-123-LNG)	Under DOE Review (12-123-LNG)
19	Waller LNG Services, LLC	0.16 Bcf/d	Approved (12-152-LNG)	n/a
20	Pangea LNG (North America) Holdings, LLC	1.09 Bcf/d [d]	Approved (12-174-LNG)	Under DOE Review (12-184-LNG)
21	Magnolia LNG, LLC	0.54 Bcf/d	Approved (12-183-LNG)	n/a

Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of April 2, 2013)

All Changes Since March 7, 2013 Update Are In Red

	Company	Quantity [a]	FTA Applications [b] (Docket Number)	Non-FTA Applications [c] (Docket Number)
22	Trunkline LNG Export, LLC	2.0 Bcf/d**	Approved (13-04-LNG)	Under DOE Review (13-04-LNG)
23	Gasfin Development USA, LLC	0.2 Bcf/d	Approved (13-06-LNG)	n/a
24	Freeport-McMoRan Energy LLC	3.22 Bcf/d***	Pending Approval (13-26-LNG)	Under DOE Review (13-26-LNG)
25	Sabine Pass Liquefaction, LLC	0.28 Bcf/d[d]	Pending Approval (13-30-LNG)	Under DOE Review (13-30-LNG)
26	Sabine Pass Liquefaction, LLC	0.24 Bcf/d[d]	Pending Approval (13-42-LNG)	Under DOE Review (13-42-LNG)
	Total of all Applications Received		**29.93 Bcf/d(**) (***)**	**28.54 Bcf/d**

** Lake Charles Exports, LLC (LCE) and Trunkline LNG Export, LLC (TLNG), the owner of the Lake Charles Terminal, have both filed an application to export up to 2.0 Bcf/d of LNG from the Lake Charles Terminal. The total quantity of combined exports requested between LCE and TLNG does not exceed 2.0 Bcf/d (i.e., both requests are not additive and only 2 Bcf/d is included in the bottom-line total of applications received).

*** Main Pass Energy Hub, LLC (MPEH) and Freeport McMoRan Energy LLC (FME), have both filed an application to export up to 3.22 Bcf/d of LNG from the Main Pass Energy Hub. (The existing Main Pass Energy Hub structures are owned by FME). The total quantity of combined FTA exports requested between MPEH and FME does not exceed 3.22 Bcf/d (i.e., both requests are not additive and only 3.22 Bcf/d is included in the bottom-line total of FTA applications received). FME's application includes exports of 3.22 Bcf/d to non-FTA countries and is included in the bottom line total of non-FTA applications received, while MPEH has not submitted an application to export LNG to non-FTA countries.

LNG Update

- U.S. Department of Energy Grants Freeport LNG Non-FTA Export Approval
- This is the first such license granted to an LNG export facility in the U.S. since approval was granted to Sabine Pass LNG in May 2011.

Source: http://gcaptain.com/u-s-energy-department-grants/ Rob Almeida, May 17, 2013

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Australia LNG
While we review, they build…

Gladstone Australia's 3 LNG plants represent $60 billion in investments

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World LNG Estimated June 2013 Landed Prices

Source: *Waterborne Energy, Inc.* Data in $US/MMBtu

Updated Mayl 23, 2013

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Incremental Demand/Supply Increase By 2020?

	Low Case	High Case
1. CNG/Natural Gas Vehicles	0.5 BCF/day	1.0 BCF/day
2. Coal to Gas	5.0 BCF/day	8.0 BCF/day
3. Industrial Demand Growth	3.0 BCF/day	7.0 BCF/day
4. LNG Exports	3.0 BCF/day	6.0 BCF/day
Incremental Demand Total	**11.5 BCF/day**	**22.0 BCF/day**
Incremental Supply Total*	**15.0 BCF/day**	**25.0 BCF/day**

*Current daily supply is 65 BCF per day.

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Conclusions

- U.S. continues to produce more gas, shale gas revolution was too successful, end-users will benefit
- During the next 3 years, supply will likely exceed demand
- Prices will remain in the $3.00 to $4.00 range, with short period above and below that band during adjustments
- Long term prices depend on demand growth. Without demand growth, supply will continue to be long and prices relatively low.
- A significant demand response can't occur for at least 3-5 years

Conclusions (cont'd)

- Infrastructure investment in the 4 areas of potential new demand (CNG/NGV, coal to gas, industrial demand growth, LNG exports) could take 5-8 years to be meaningful
- Natural gas liquids will continue to be the driving force in drilling
- BTU value disparity between natural gas and crude oil will continue for many years
- Beware of entities that are "talking their own book" (ie – chemical and manufacturing trade associations, LNG developers, NGV advocates, etc.)
- Exports must become a greater part of the demand equation, with obvious political implications.

Wildcards

- World economy (every one is “talking their own book”)
- Ban on hydraulic fracturing in U.S. (it is a battle city by city, town by town)
- Quad “O”
- The Streetlight Effect

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Fracturing: Big Three Issues

- **Waste Water Disposal**: Re-injection is generally best option. Viable and safe in most all areas.
- **Air Pollution**: Industrial activity on site – burning diesel like farm equipment and possible hazard from methane gas escaping (casing head gas).
- **Community / Landowner issues**. Biggest one in my opinion. Different communities evaluate tradeoffs differently. Benefit sharing is also variable.
- Fracture growth up into groundwater is a hyped but not real issue. Surface handling of water / chemicals is a real issue, as is casing / cement integrity.

Citations for Report

All of the information utilized for this report is a compilation of information pulled from the following data sources:

Ponderosa Advisors LLC
Blue, Johnson Associates, Inc.
Chris Wright, Liberty Resources
Office of Fossil Energy
Dave Pursell, Tudor Pickering Holt & Co
Tudor Pickering Holt & Co
Bloomberg
America's Natural Gas Alliance
HPDI
RigData
SNL Energy
Office of Oil Gas Global Security Supply
U.S. Department of Energy
Raymond James and Associates, Inc.
Charif Souki, Cheniere Energy Inc.; Cheniere Research
U.S. Federal Energy Regulatory Commission
Institute for Energy Research (IER)
Energy Information Administration (EIA)
Bernstein Research
Western Energy Alliance
Platts Gas Daily Report, A McGraw Hill Publication
SEC Filings

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What Fracking Means to Low Income Households

2003-2008 NYMEX[1] Avg. Price[2]/MMBtu	$7.21	61% Drop
2012 NYMEX[1] Avg. Price/MMBtu	- $2.80	
Price Differential/MMBtu	$4.41	
	x	
2012 Residential Gas Usage[3]/MMBtu	4,179,740,000	

2012 Residential Cash Savings = **$18,432,653,400**

1 NYMEX – Average last 3 days of close of Natural Gas Contract as reported in Platts Gas Daily Report

2 See Addendum A for supporting documentation

3 2012 Residential Gas Usage – EIA Natural Gas Consumption by End Use

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What Fracking Means to Low Income Households

- 36% of residential households (114 million total[4]) are estimated to qualify for LIHEAP assistance[5]

2012 Residential Cash Savings	**= $18,432,653,400**
Percentage of Low Income Households[6]	**x .36**
2012 Low Income Cash Savings	**= $6,635,755,224**
2012 LIHEAP Total Cash Assistance[7]	**= $2,625,000,000**

4 US Census Bureau State and County Quickfacts

5 LIHEAP Home Energy Notebook for FY 2009: Appendix B: Income Eligibility Household Estimates; See Addendum A

6 Households with income up to 150% of the federal poverty income guidelines or, if greater, 60% of the state median income

7 10% decrease due to General Administrative Expense; 15% due to efficiency

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The Effect of Fracking on Residential Gas Cost

- With the gas cost in **Spain** of **$10.05/MMBtu**, the total residential bill would have been:

$67.84

80% Increase

- With the gas cost in **China** of **$13.70/MMBtu**, the total residential bill would have been:

$82.29

118% Increase

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