

# HART ENERGY



## North American Shale/Tight Gas – A Game Changer –

June 6, 2012  
Kuala Lumpur, Malaysia

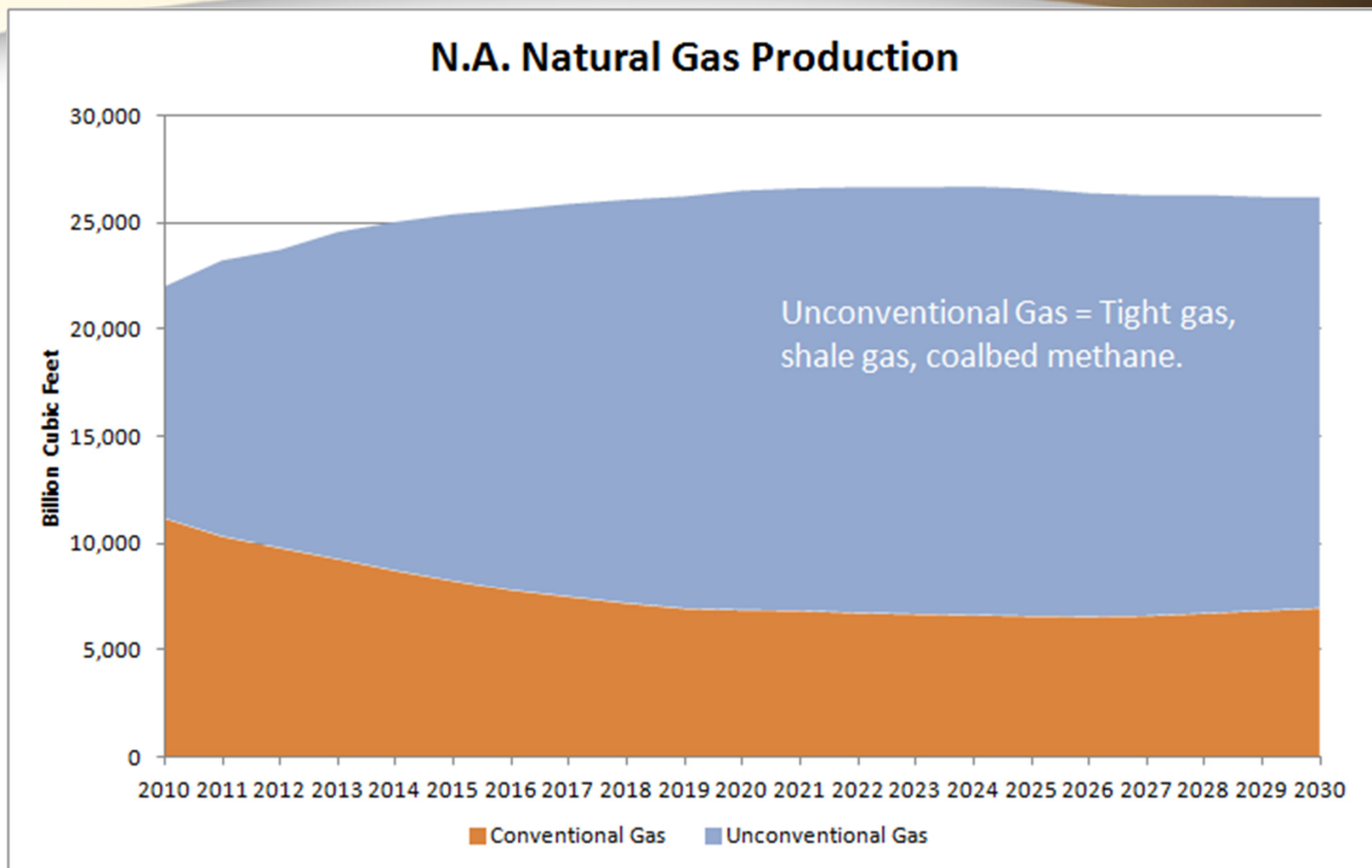
# Outline

- The Game Has Changed
- The Gear for the Game
- An Abundance of Shale/Tight Resources
- Technology is Key
- End Use Sectors
- Impact on North American Crude Oil Production

# The Game Has Changed

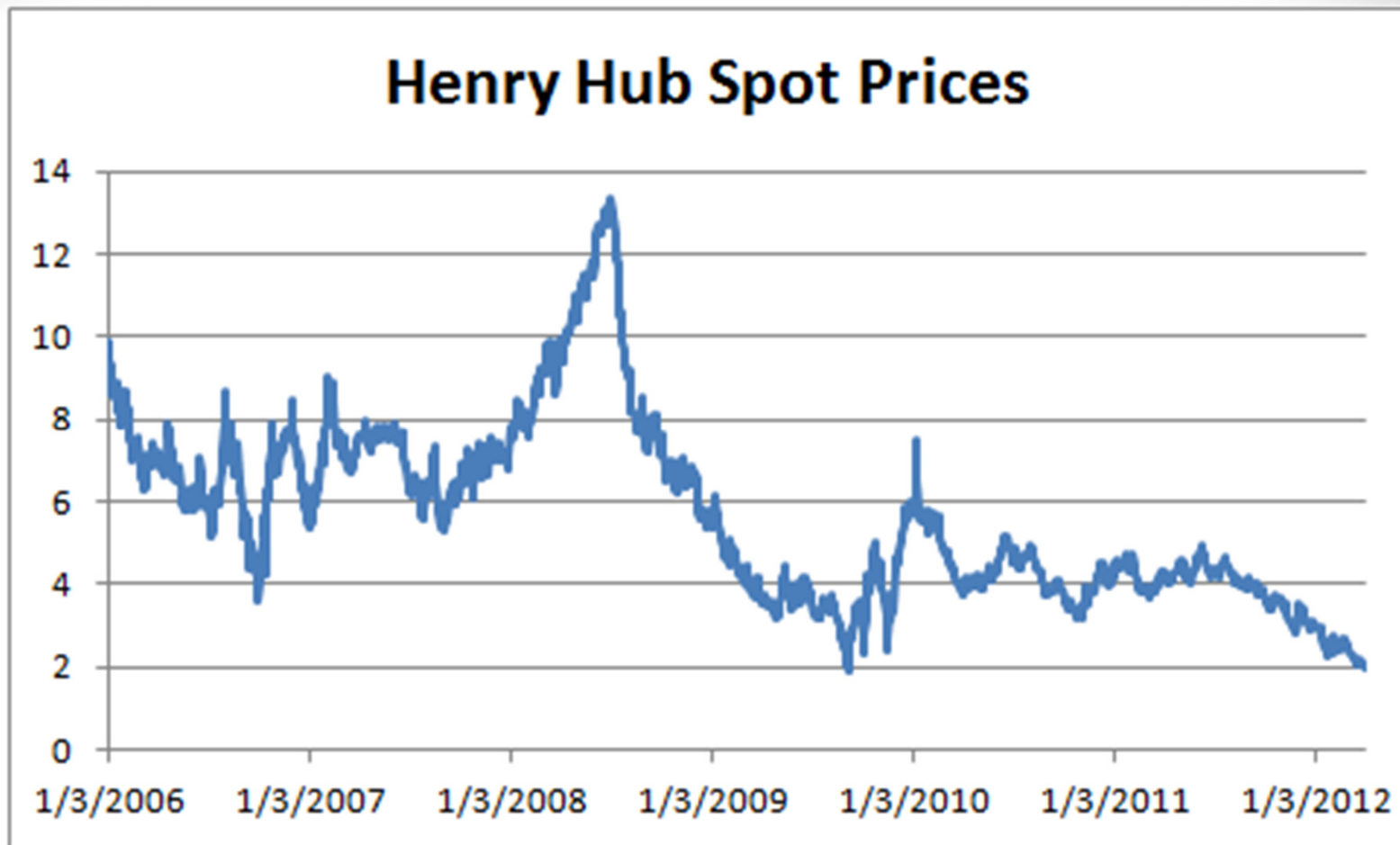
# N.A. Shale Gas

## U.S. Natural Gas Production



# U.S. Shale Gas

## Henry Hub Natural Gas Prices (daily)



# The Gear for the Game

# The Gear for the Game

## - Public Data Sources -

### Government

### Industry

The screenshot shows the U.S. Energy Information Administration (EIA) website in a Mozilla Firefox browser. The page features a navigation menu with 'Sources & Uses', 'Topics', and 'Geography'. A search bar is visible. The main content area is divided into several sections: 'Petroleum & Other Liquids', 'Coal', 'Natural Gas', 'Renewable & Alternative Fuels', 'Electricity', 'Nuclear & Uranium', 'Consumption & Efficiency', and 'Total Energy'. A 'Highlights' sidebar on the right lists recent reports such as 'This Week in Petroleum', 'Weekly Petroleum Status Report', and 'Weekly Natural Gas Storage Report'. The URL in the address bar is <http://www.eia.gov>.

The screenshot shows the Baker Hughes Rig Count website in a Mozilla Firefox browser. The page features a navigation menu with 'CONTACT', 'CAREERS', 'PRESS ROOM', and 'RESOURCES'. A search bar is visible. The main content area is titled 'RIG COUNT' and features a map of the United States with red and blue markers indicating drilling activity. A sidebar on the right contains contact information: 'We're here to help +1.800.229.7447', 'Baker Hughes Incorporated 2929 Allen Parkway Houston, TX 77019', and 'Get local support Select a regional contact'. The URL in the address bar is <http://www.bakerhughes.com/rig-count>.

# The Gear for the Game


## - Hart Energy Research -

### Hart Energy Shale Research Service

**HARTENERGY**

**North American Shale Quarterly**

*A Unique Service Covering All Companies and Their Activities in the Top 20 North American Shale Oil and Gas Plays*



**Provided For Each Play:**

- >> Valuation Map with company well overlays
- >> Production forecast to 2015
- >> Company acreage, reserves and highlights
- >> Play economics including break-even prices on a company basis
- >> Infrastructure coverage of each play


### Hart Energy Research Products



**HARTENERGY**


**Global Shale Oil Study**

*The industry's most exhaustive evaluation of shale-oil geological prospects around the globe*



**A comprehensive report providing:**

- >> An assessment of 70+ shale plays in all regions of the world, highlighting geological aspects and key properties of each play
- >> Current activities in each region/play, key market drivers, infrastructure, fiscal terms and challenges to commercial development
- >> Lessons learned from North America: well decline patterns, drilling and completion techniques, economics


With analytical contribution from 

[www.hartenergy.com](http://www.hartenergy.com)

**HARTENERGY**

**Global Shale Gas Study**

*The Industry's Most Comprehensive Assessment of Reservoirs and Opportunities*



**A 200+ page report providing**

- >> A review and assessment of 100+ shale plays in all regions of the world, highlighting geological aspects and key properties of each play
- >> Current activities in each region/play, key market drivers, infrastructure, fiscal terms and challenges to commercial development
- >> Data requirements and how to evaluate a shale gas play
- >> Shale gas development considerations – well decline patterns, cost control techniques and shale gas economics under varying gas prices, development costs and fiscal terms

Hart Energy Research Group

[www.hartenergy.com](http://www.hartenergy.com)



# **An Abundance of Shale/Tight Resources**

# An Abundance of Shale/Tight Resources



## Canada shale gas and unconventional tight oil

Production 2011: 414 kboe/d, 27% oil, 23% growth in 2012

Wellcapex 2011: 6.2 BUSD, 14% growth in 2012

## U.S. shale gas plays

Production 2011: 19 bcfe/d, 9% growth in 2012

Wellcapex 2011: 24 BUSD, 7% decline in 2012

## U.S. unconventional tight oil plays

Production 2011: 1,286 kboe/d, 57% oil, 73% growth in 2012

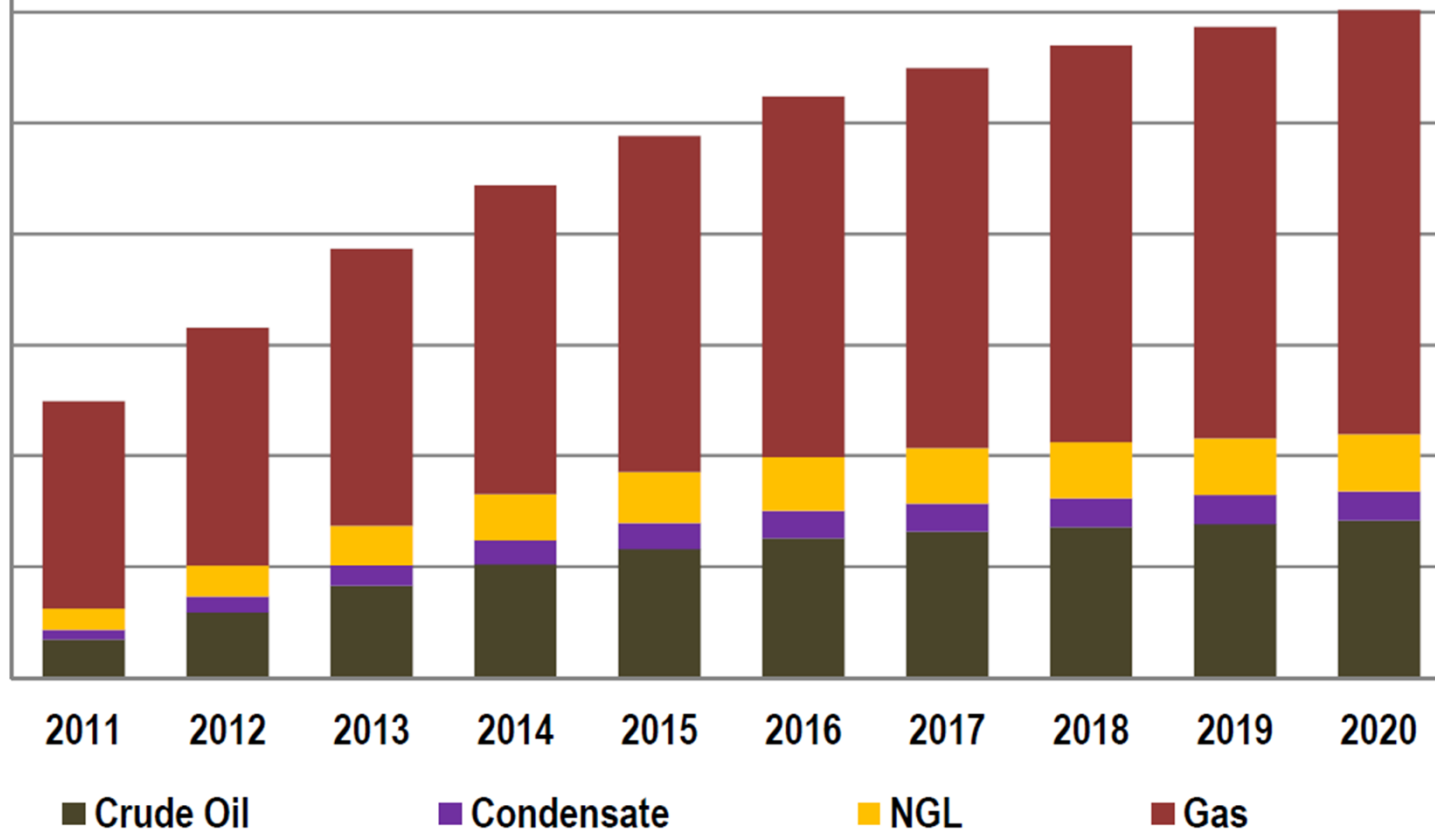
Wellcapex 2011: 32 BUSD, 34% growth in 2012

### Valuated Shale Plays:

- 1 - Alberta Bakken
- 2 - Bakken and Three Forks
- 3 - Barnett
- 4 - Cardium
- 5 - Eagle Ford
- 6 - Fayetteville
- 7 - Granite Wash
- 8 - Haynesville/Bossier
- 9 - Horn River
- 10 - Marcellus
- 11 - Montney
- 12 - Niobrara
- 13 - Permian Basin
- 14 - Utica
- 15 - Woodford

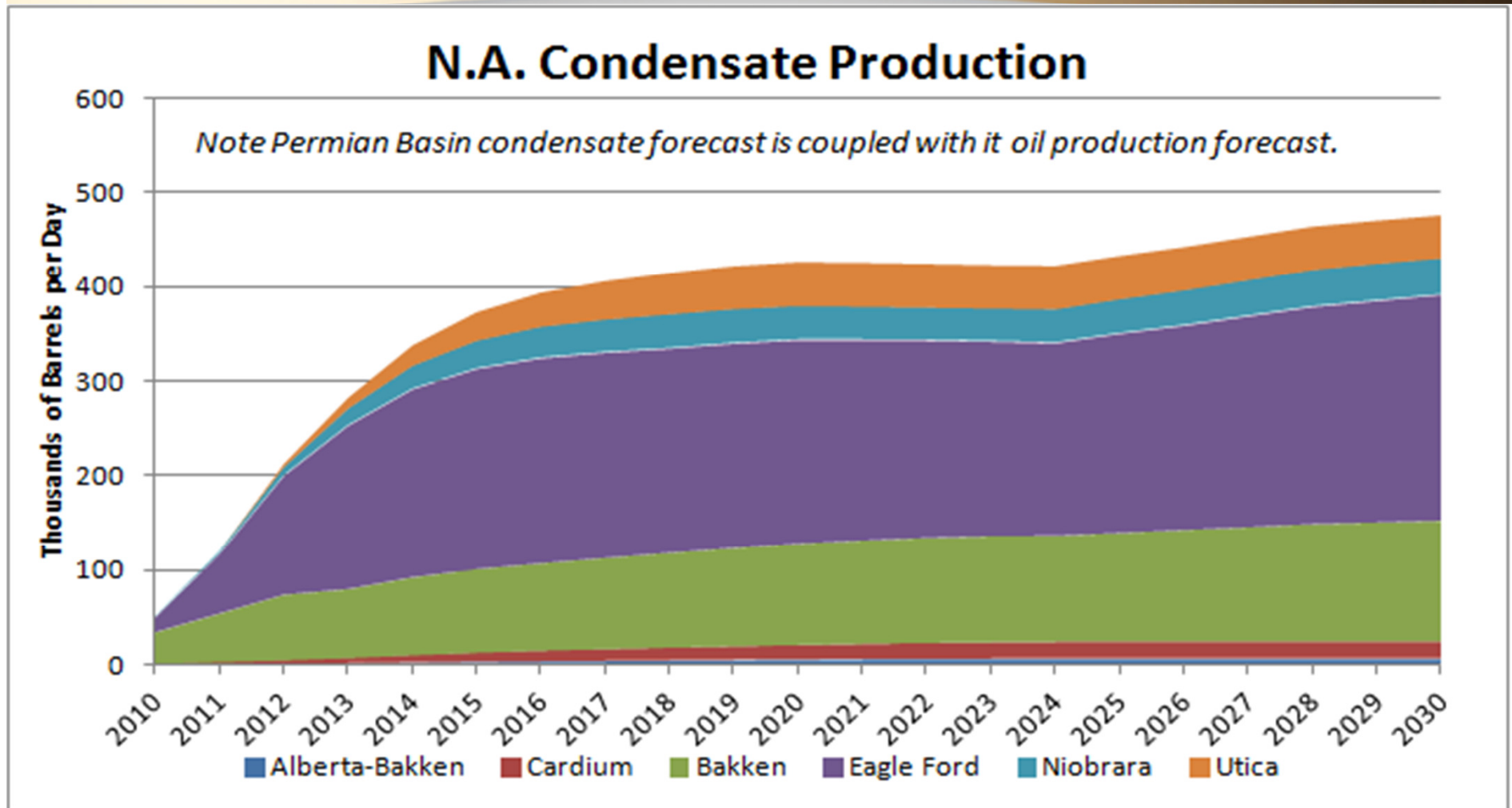
# An Abundance of Shale/Tight Resources

## Shale & Tight Resource Production, BOE/d



Sources: Hart Energy North American Shale Quarterly, Rystad

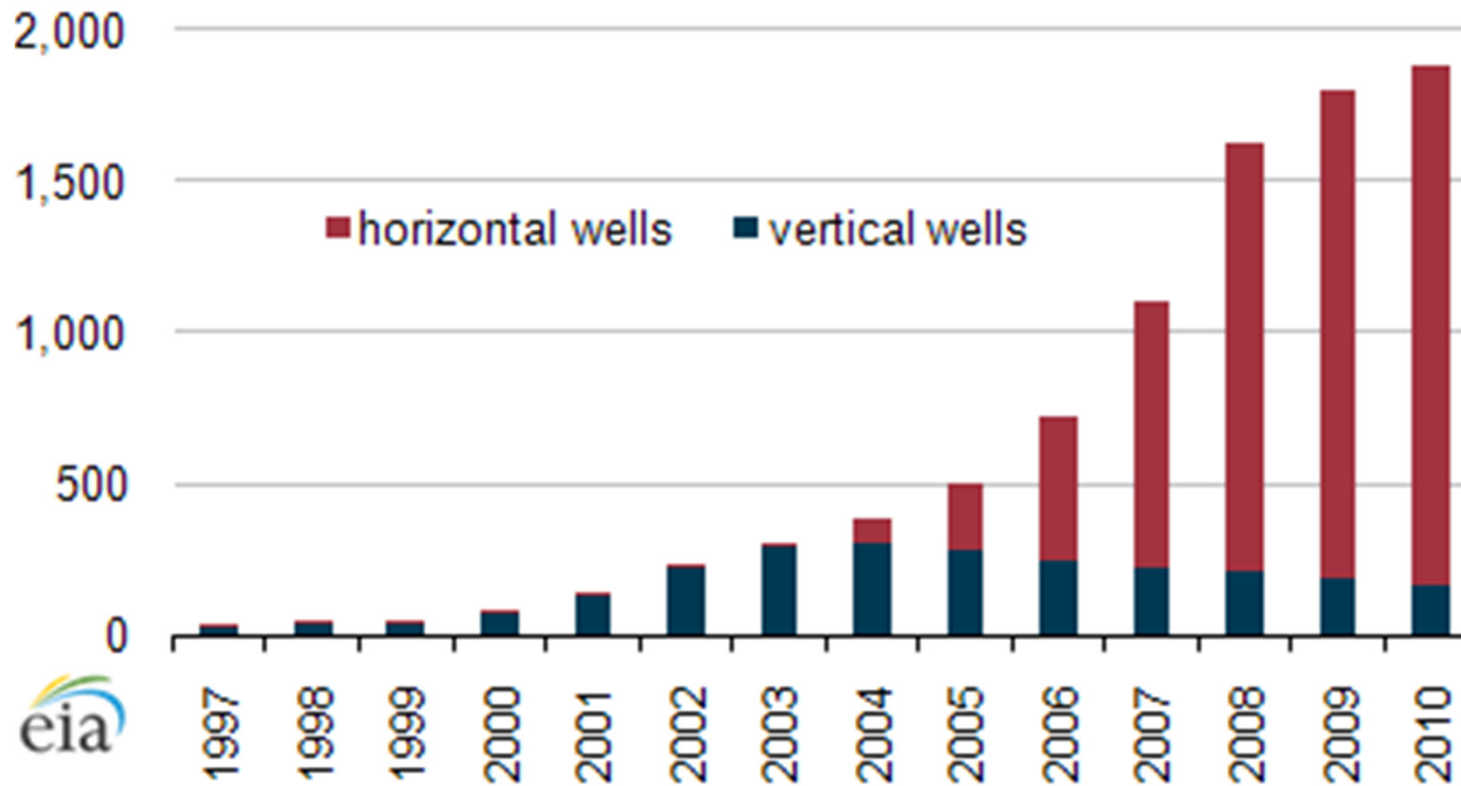
# N.A. Shale/Tight Oil Plays Condensate Production



Sources: Rystad Energy in partnership with Hart Energy

# Abundance: Barnett Shale

Annual Barnett shale natural gas production by well type  
billion cubic feet (Bcf)



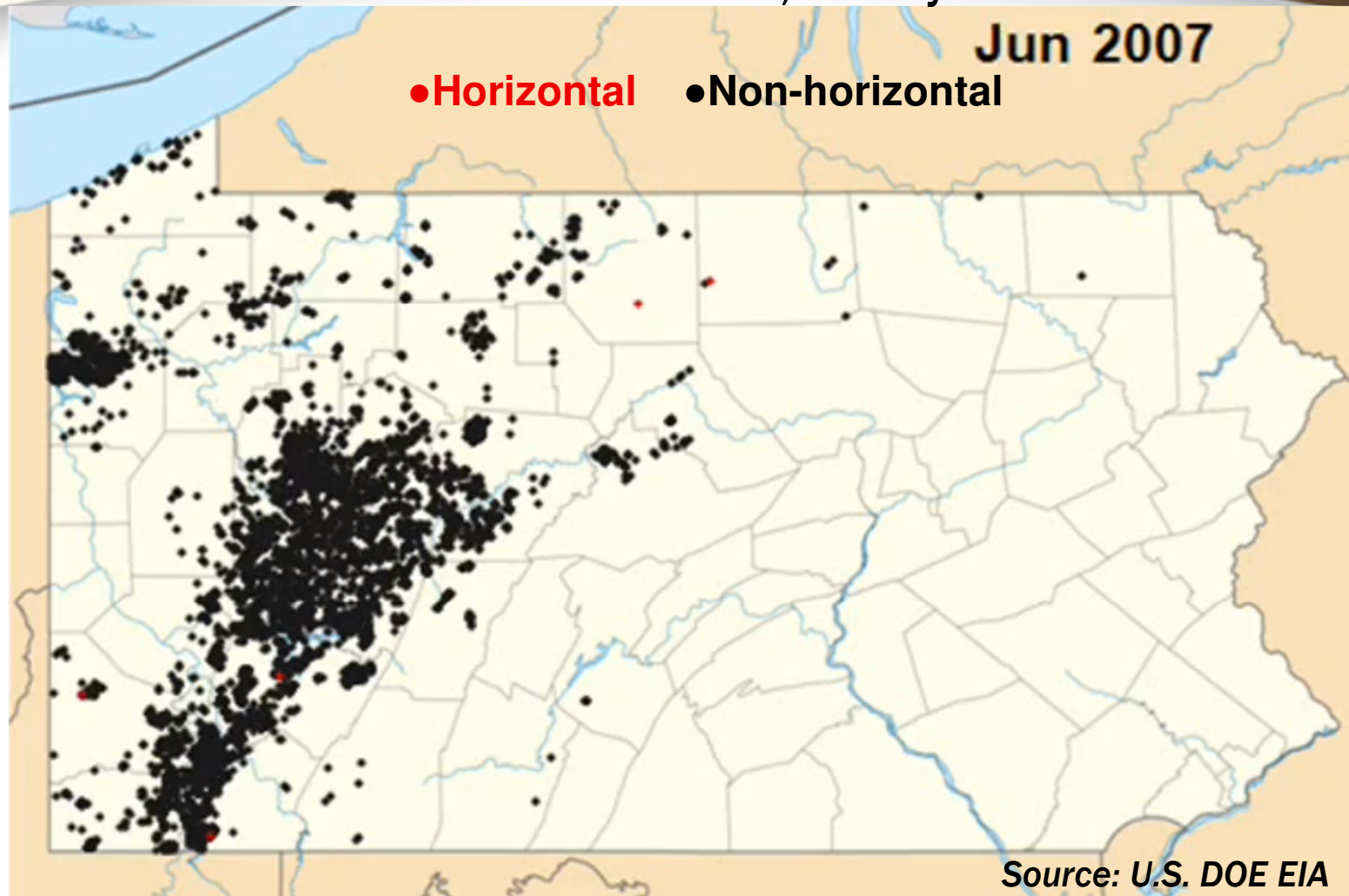
Source: U.S. DOE EIA



# An Abundance of Shale/Tight Resources

## Marcellus Shale Drilling Pre-Game

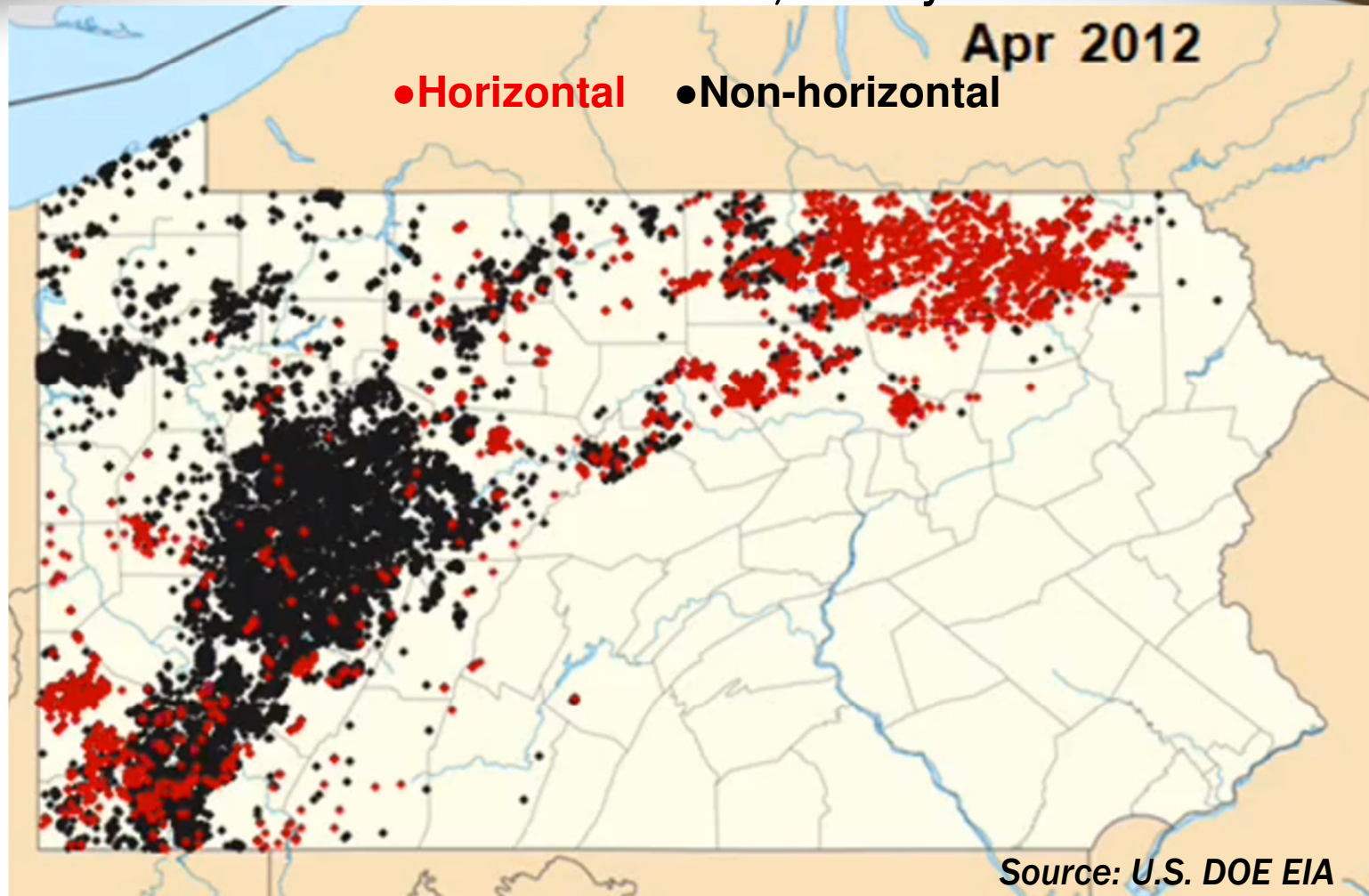
Cumulative Gas Wells, Pennsylvania



# An Abundance of Shale/Tight Resources

## Marcellus Shale Drilling - GAME ON!

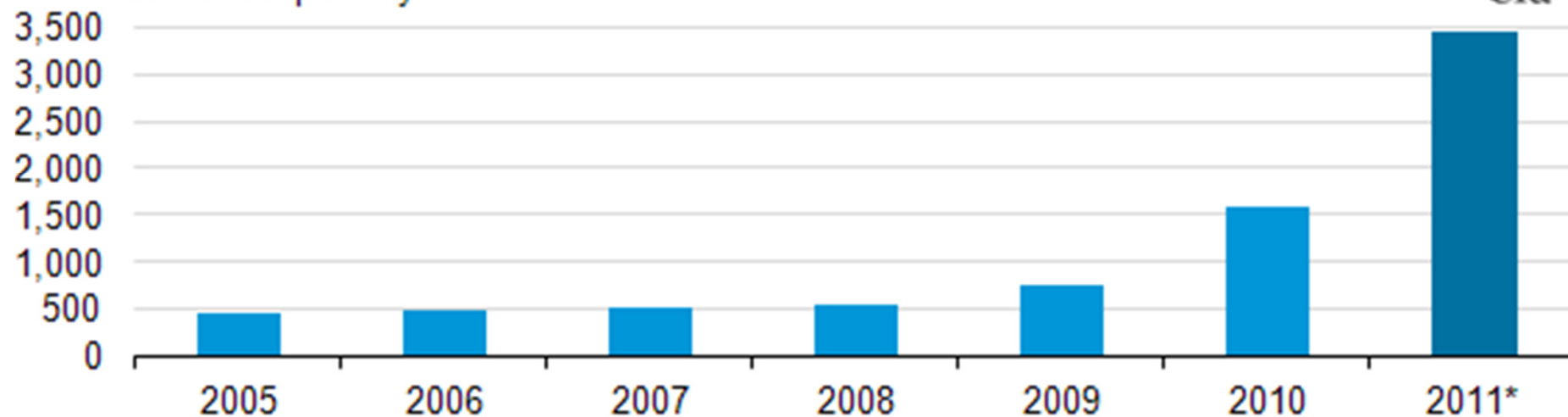
Cumulative Gas Wells, Pennsylvania



# An Abundance of Shale/Tight Resources

## Marcellus Shale Drilling - GAME ON!

Pennsylvania's natural gas production  
million cubic feet per day



Source: U.S. DOE EIA

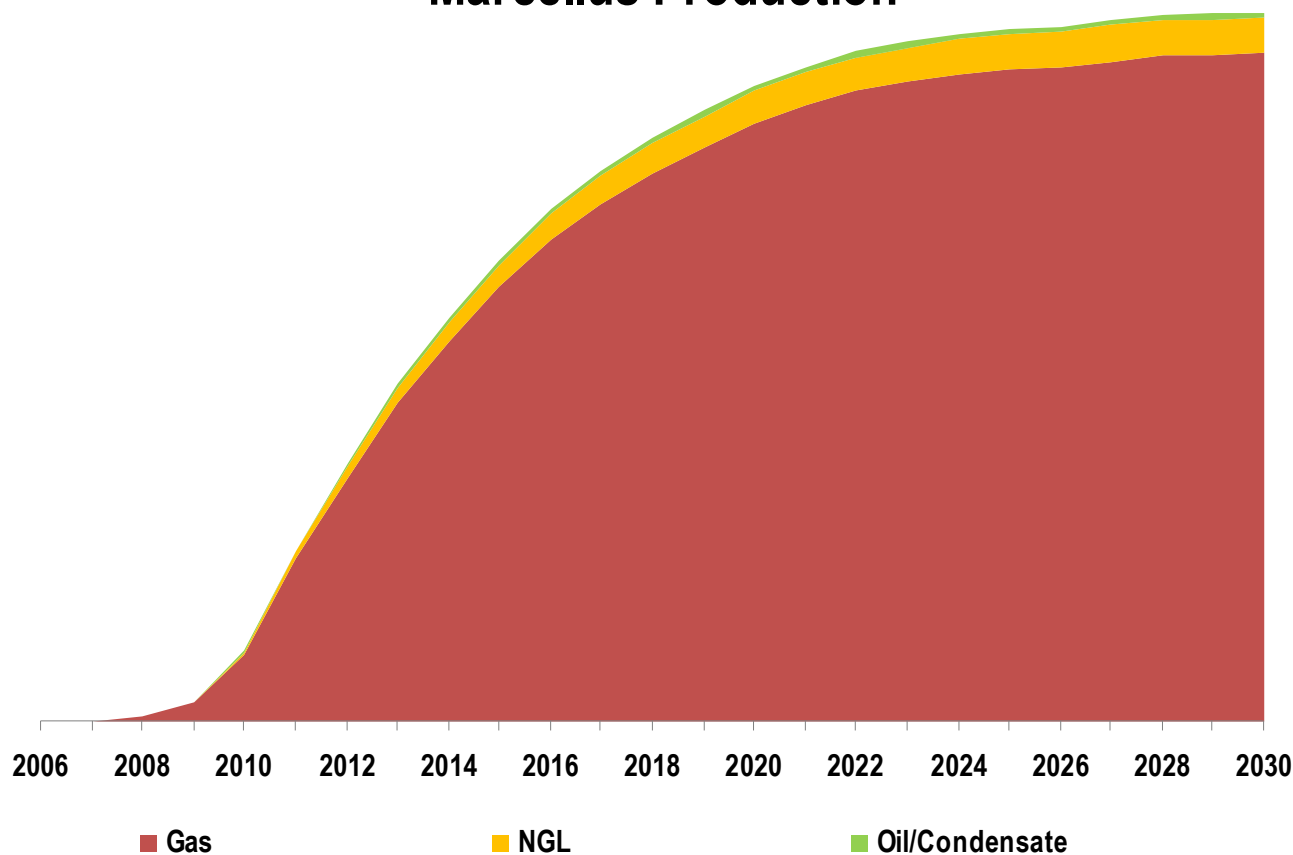


# An Abundance of Shale/Tight Resources

## Marcellus Shale Production (NASQ 1Q12)

- GAME ON! -

### Marcellus Production

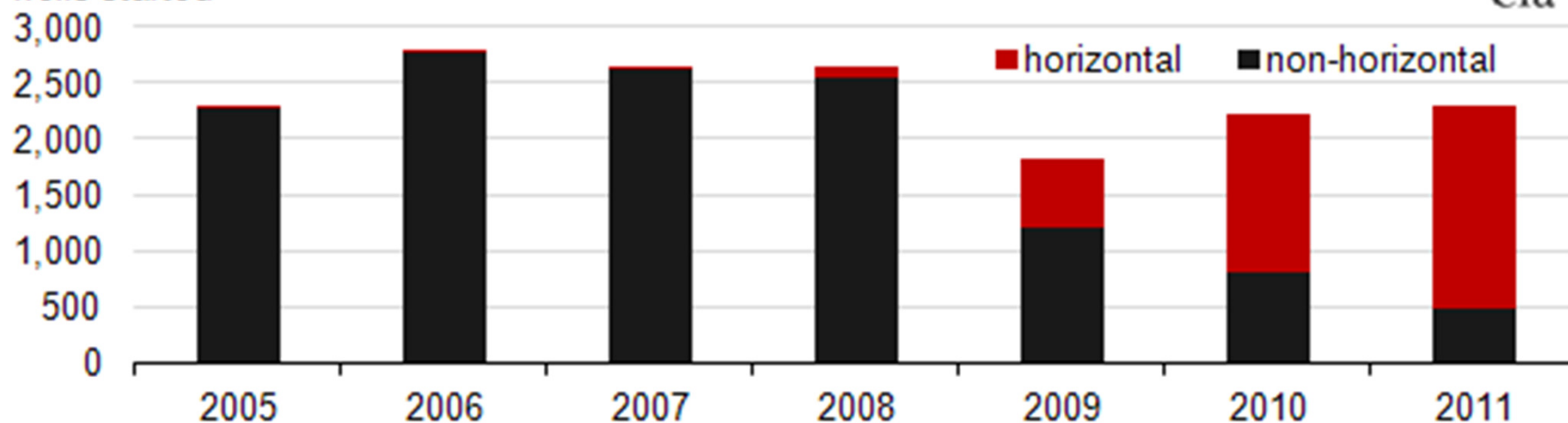


Sources: Hart Energy North American Shale Quarterly, Rystad

# An Abundance of Shale/Tight Resources

## Marcellus Shale Drilling - Early in the Game

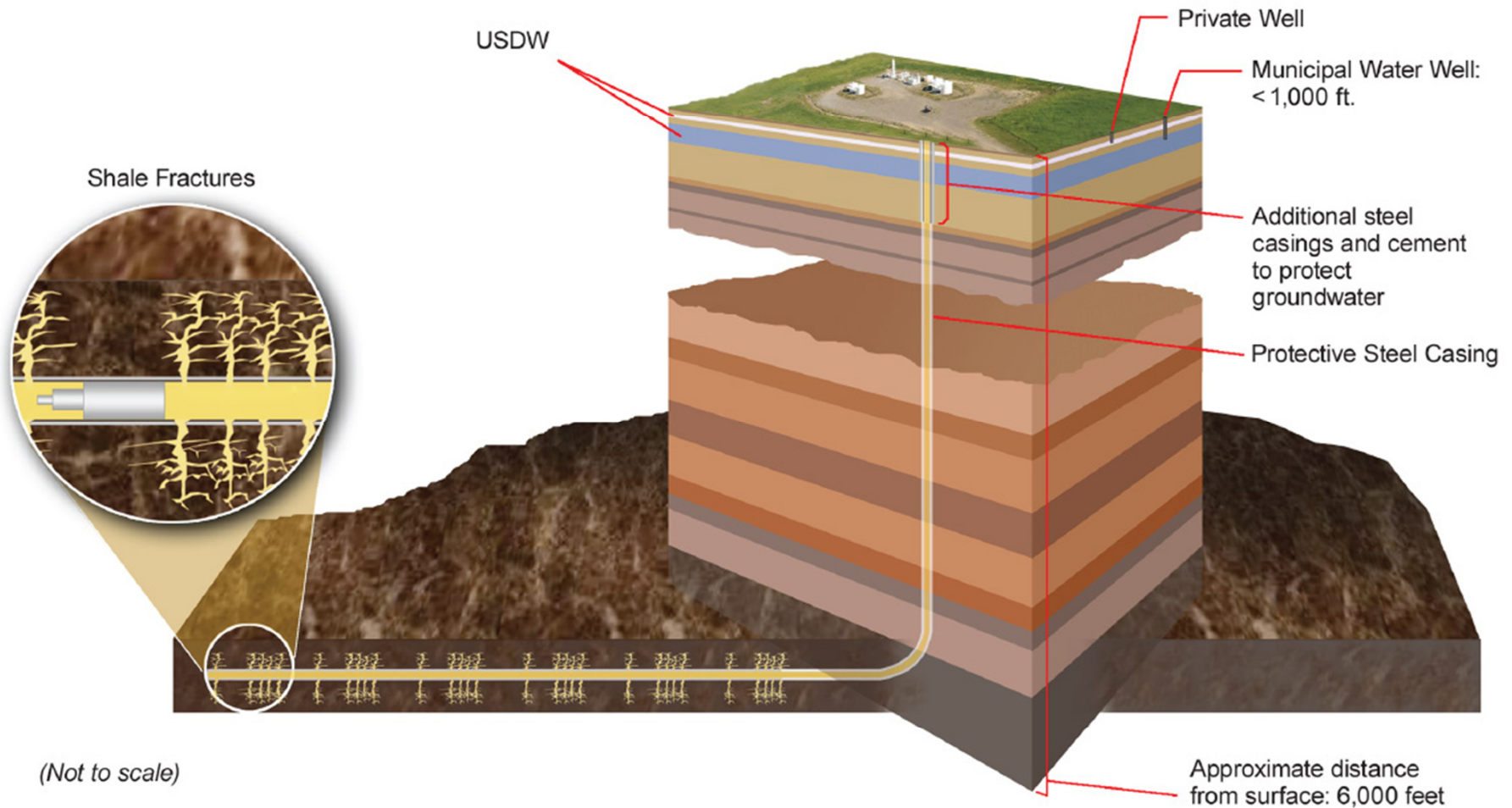
Annual natural gas well starts in Pennsylvania  
wells started



Source: U.S. DOE EIA

**Technology is Key**

# Technology is Key

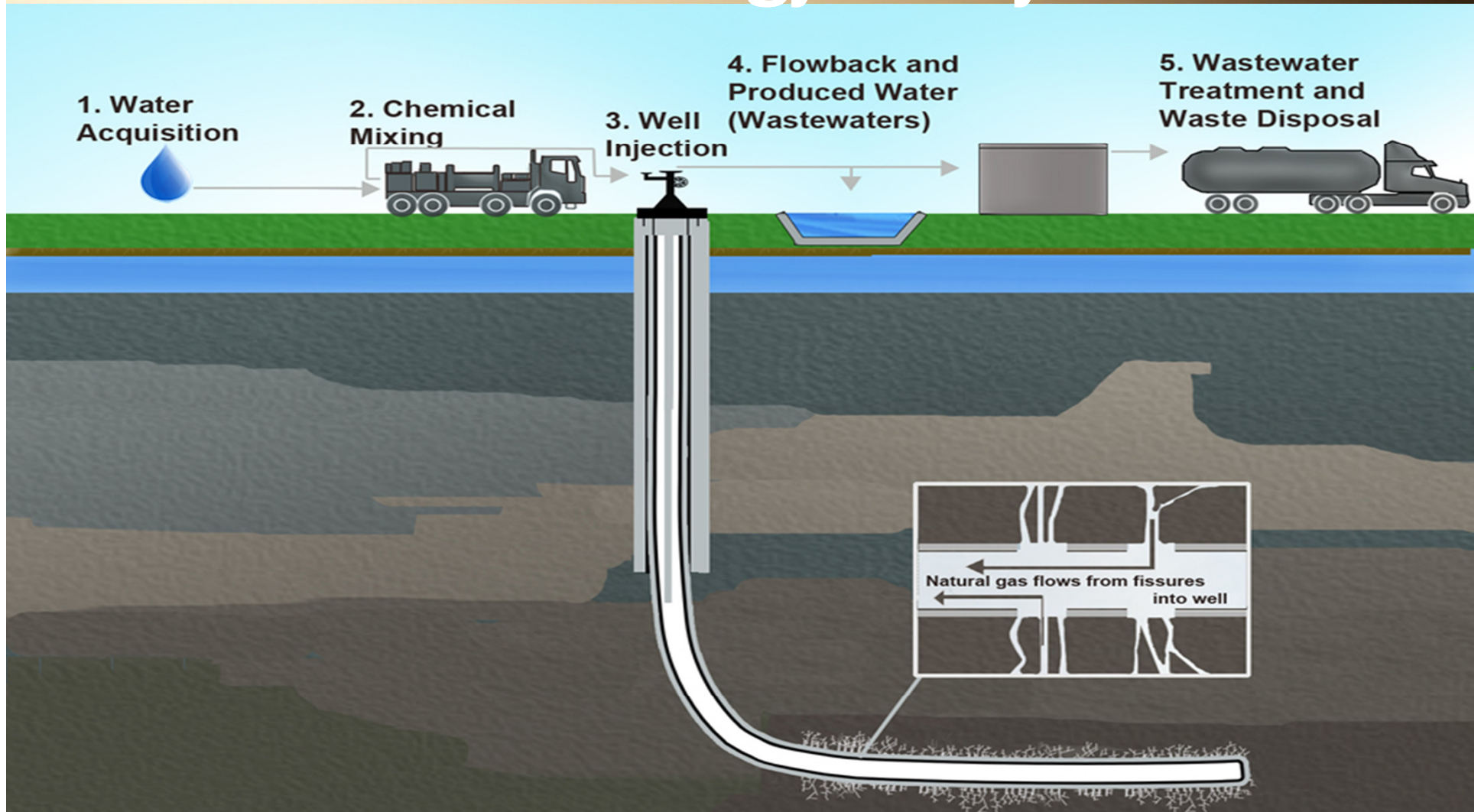


(Not to scale)

Steel casing lines the well and is cemented in place to prevent any communication up the wellbore as the fracturing job is pumped or the well is produced. Shallow formations holding fresh water that may be useful for farming or public consumption are separated from the fractured shale by thousands of feet of rock.

Source: U.S. DOE EIA

# Technology is Key



Source: U.S. EPA

# Technology is Key

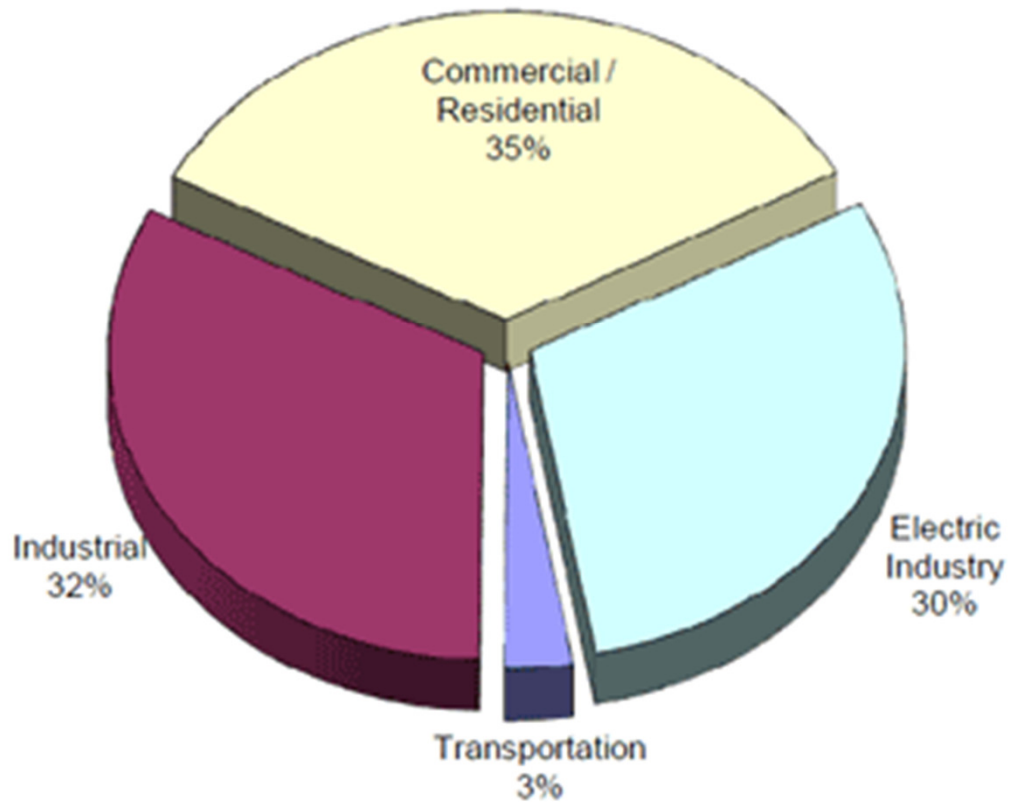


*Source: U.S. DOE EIA*

# End Use Sectors

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**U.S. 2009 Natural Gas Use by Segment**  
*23.4 Quadrillion BTU Total, 2009*

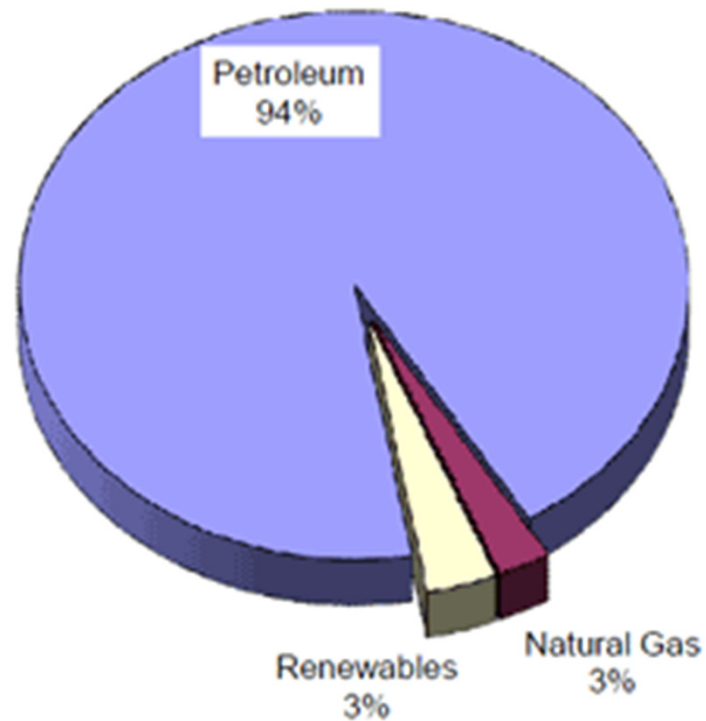




# End Use Sectors

## U.S. Transportation ?

**Transportation Energy Use by Type**  
*27 Quadrillion BTU Total, 2009*

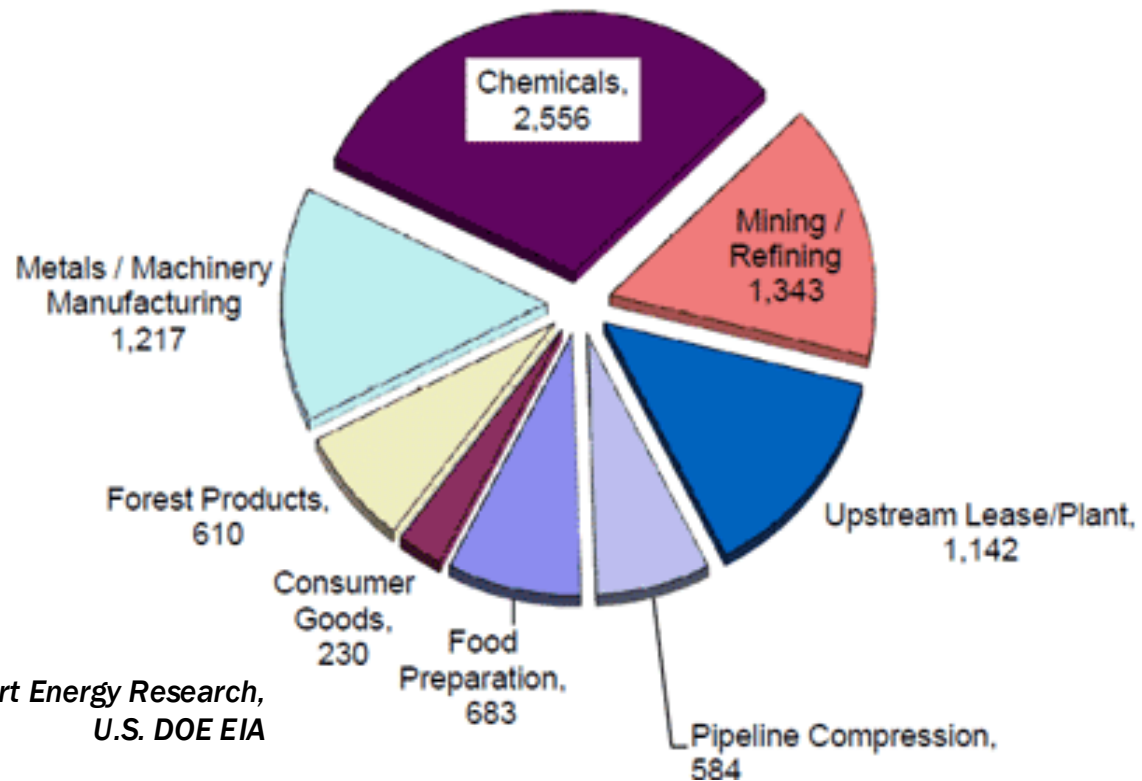


Source: Hart Energy Research, U.S. DOE EIA

# End Use Sectors

## Industrial ?

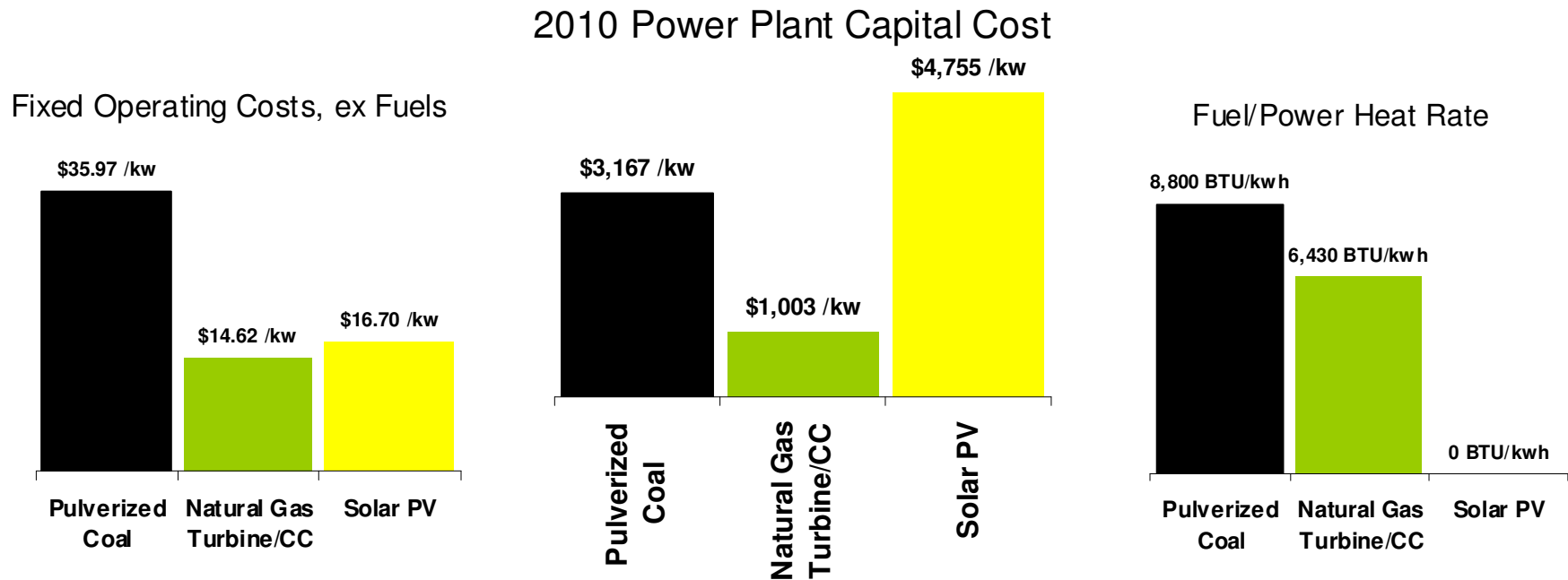
Industrial Use of Natural Gas and NGLs  
(Units in Quadrillion BTU)



Source: Hart Energy Research,  
U.S. DOE EIA

# End Use Sectors

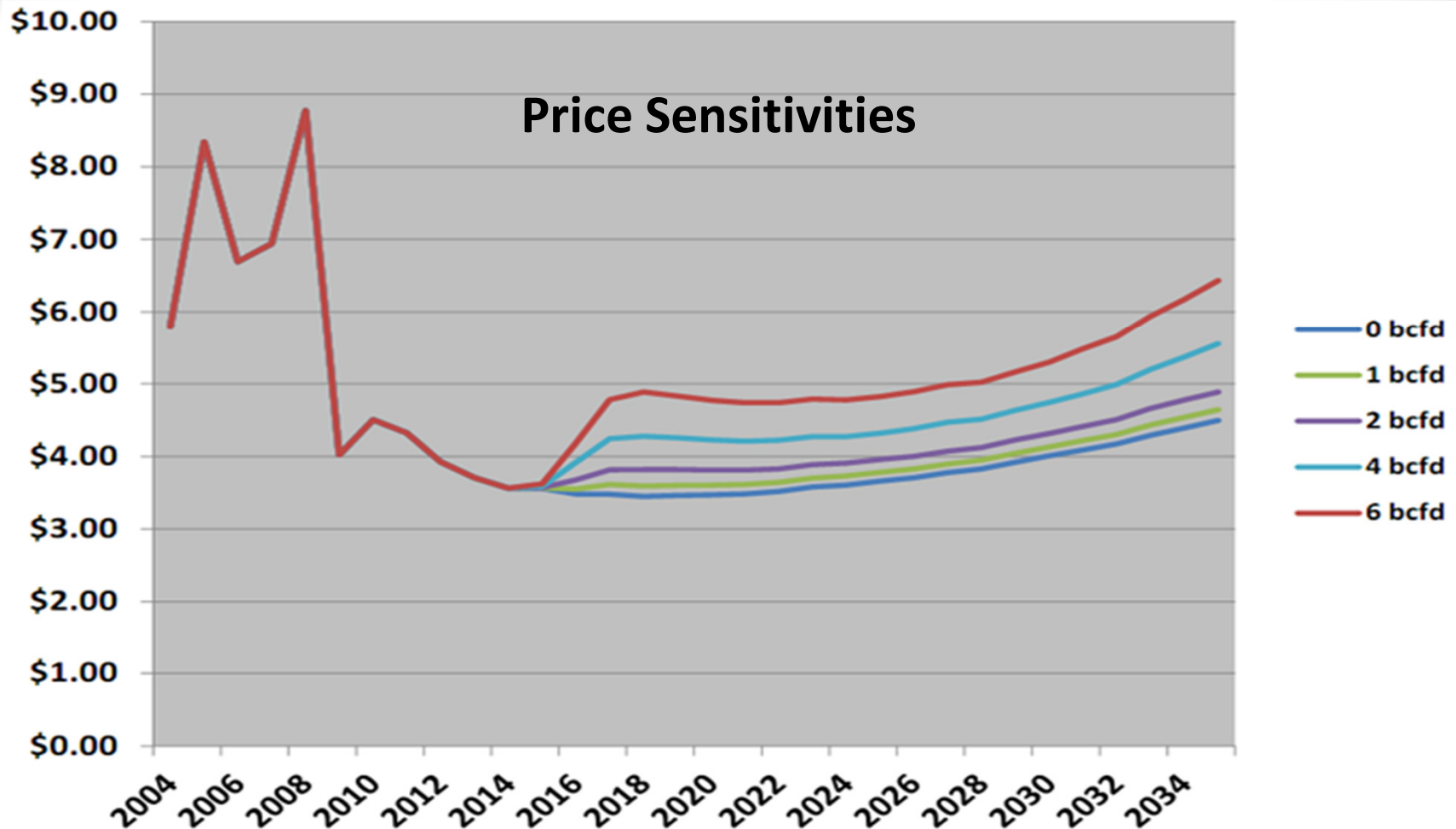
## Power Generation ?



Source: Hart Energy Research, U.S. DOE EIA

# End Use Sectors

## - LNG Export Markets? -

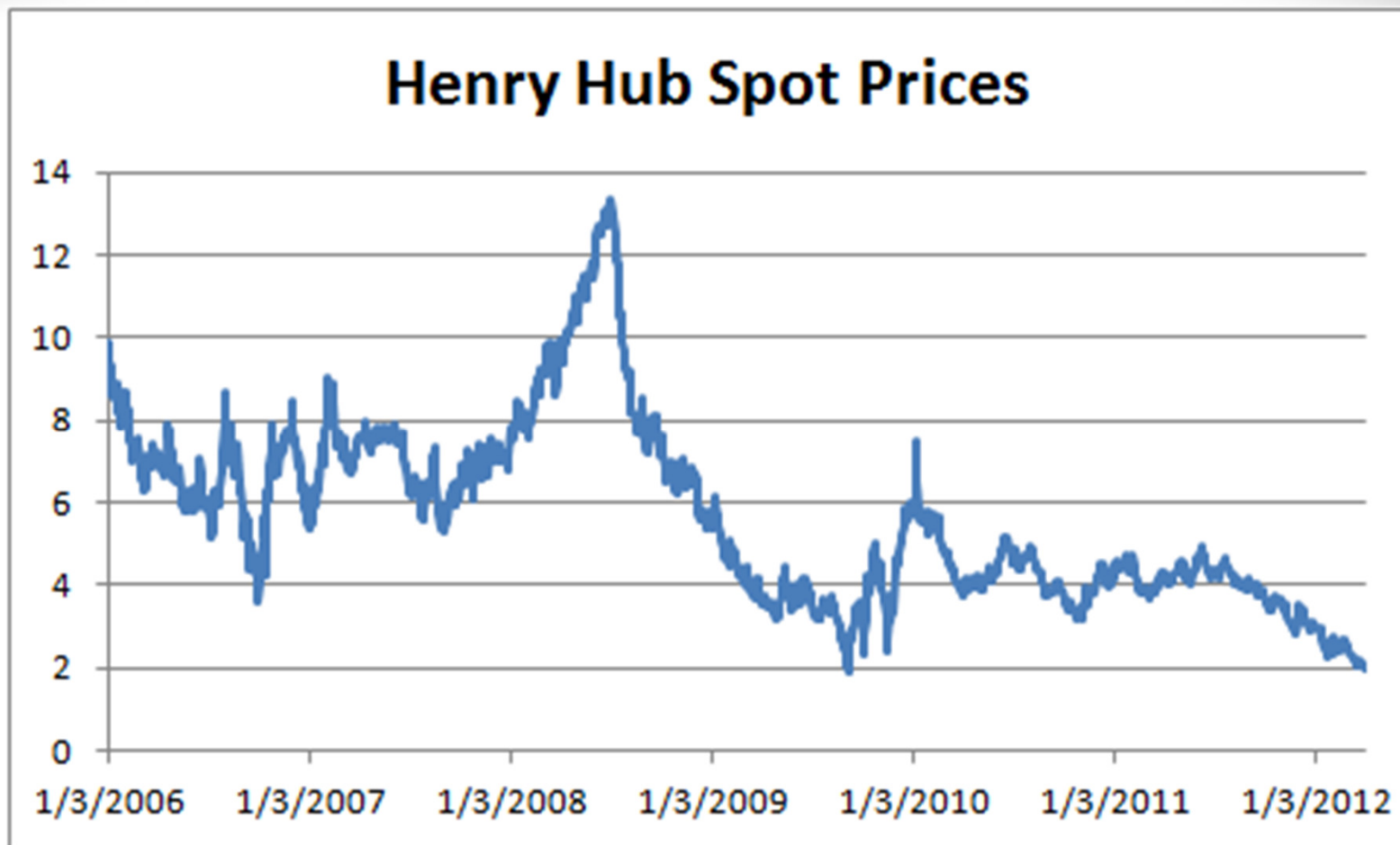


Sources: RBAC in partnership with Hart Energy

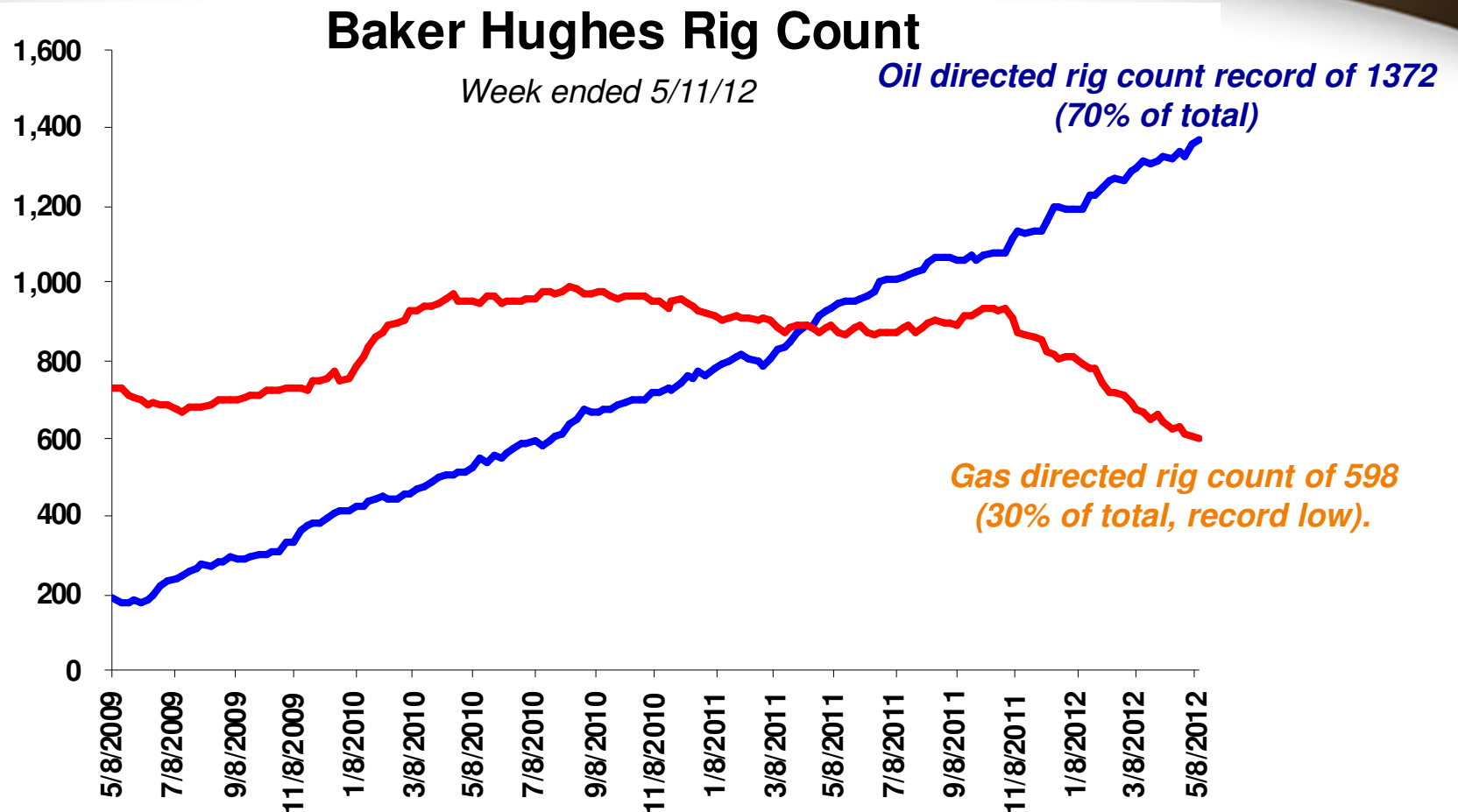
# Impacts Extend Beyond Gas to Oil

# Impact on Prices Drives Shift to Liquids

## Henry Hub Natural Gas Prices (daily)



# Impact on Prices Drives Shift to Liquids



Source: [www.BakerHughes.com](http://www.BakerHughes.com) EIA

# Impact on Prices Drives Shift to Liquids

## North American Liquids-Rich Plays



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# Impact on Prices Drives Shift to Liquids

## North American Liquids-Rich Plays

Utica



Bakken/Three Forks



Eagle Ford



- Crude Oil
- Condensate
- NGL
- Gas

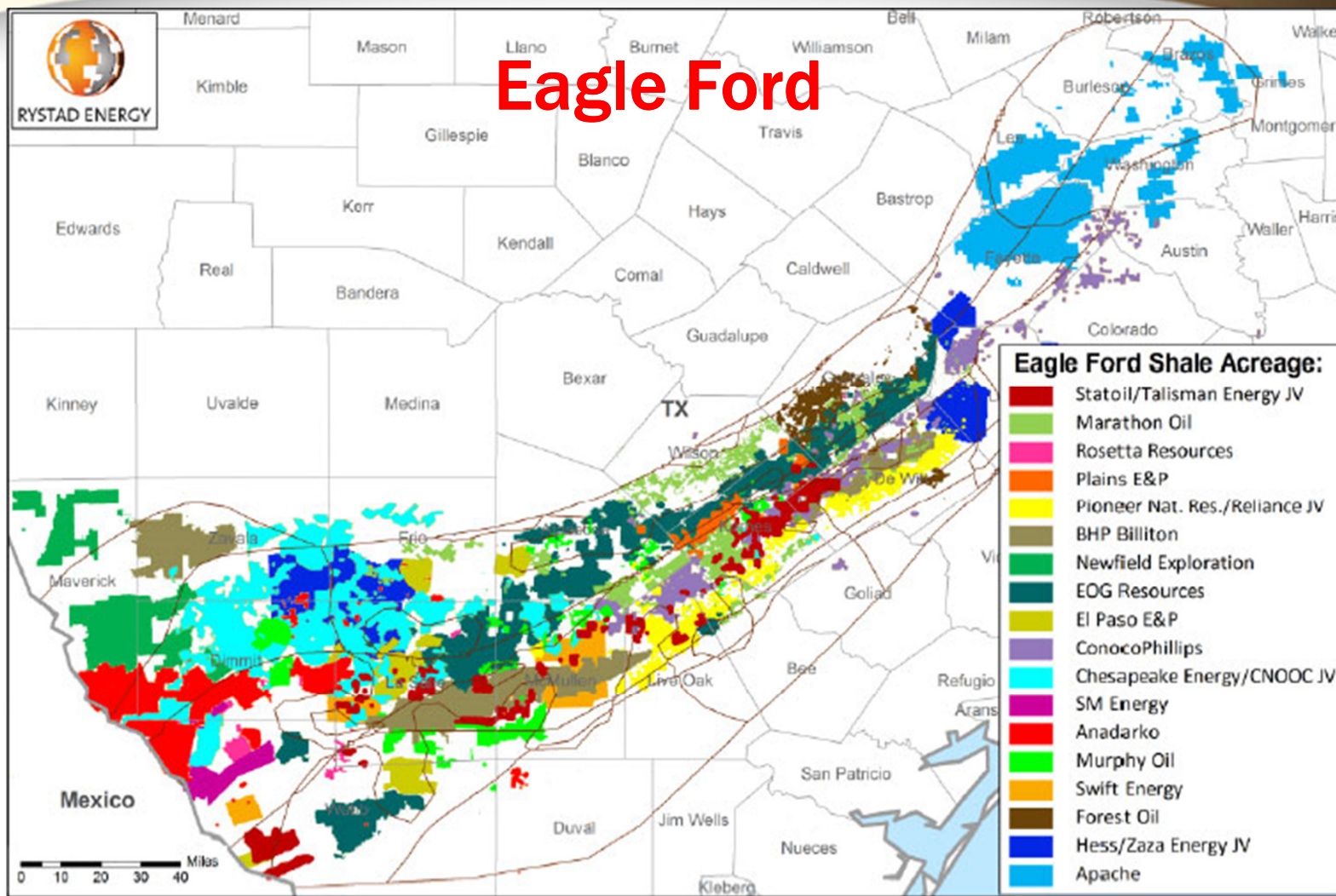
Permian



- Oil + Cond
- NGL
- Gas

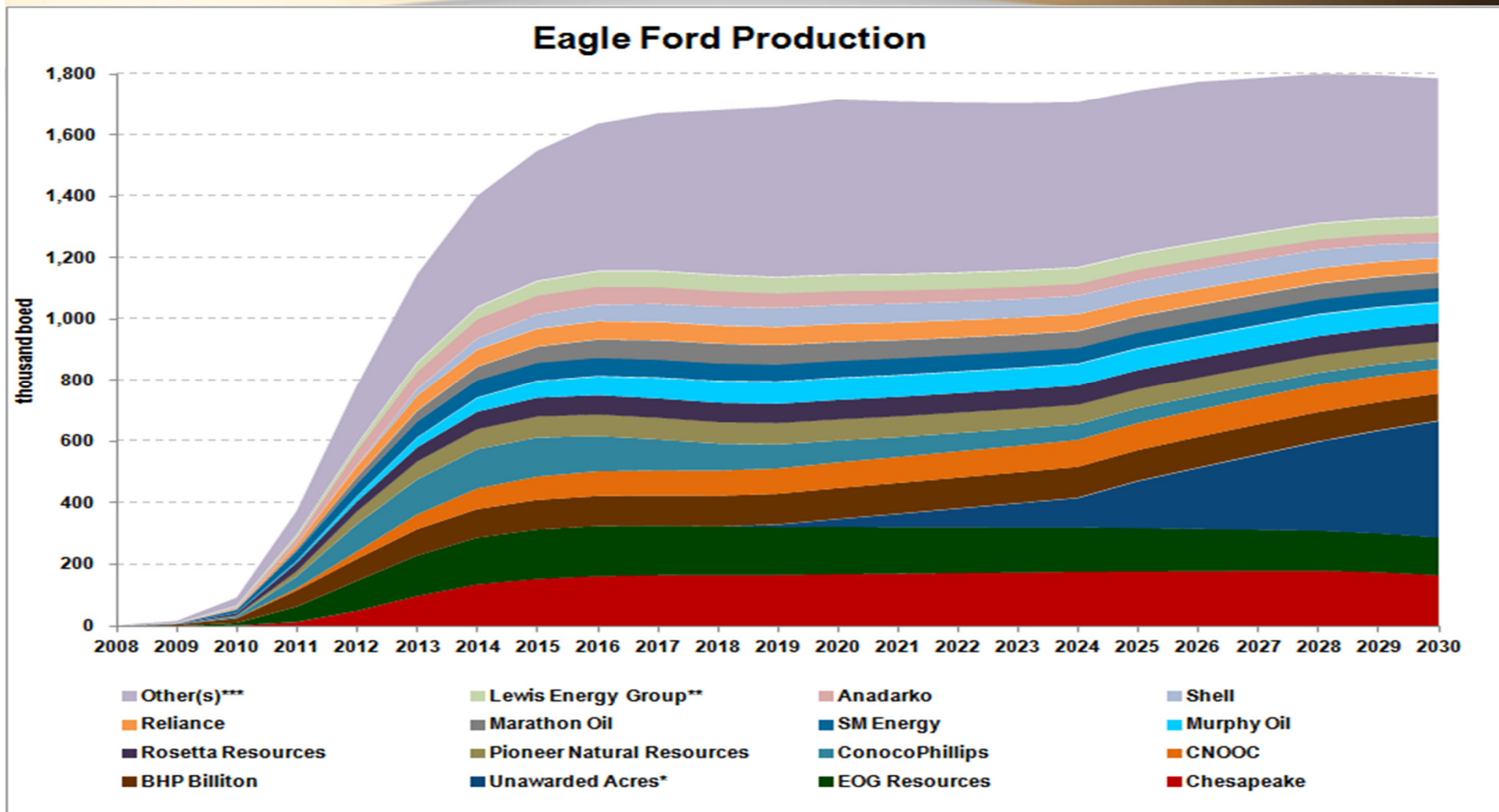
# Impact on Prices Drives Shift to Liquids

## North American Liquids-Rich Plays



# Impact on Prices Drives Shift to Liquids

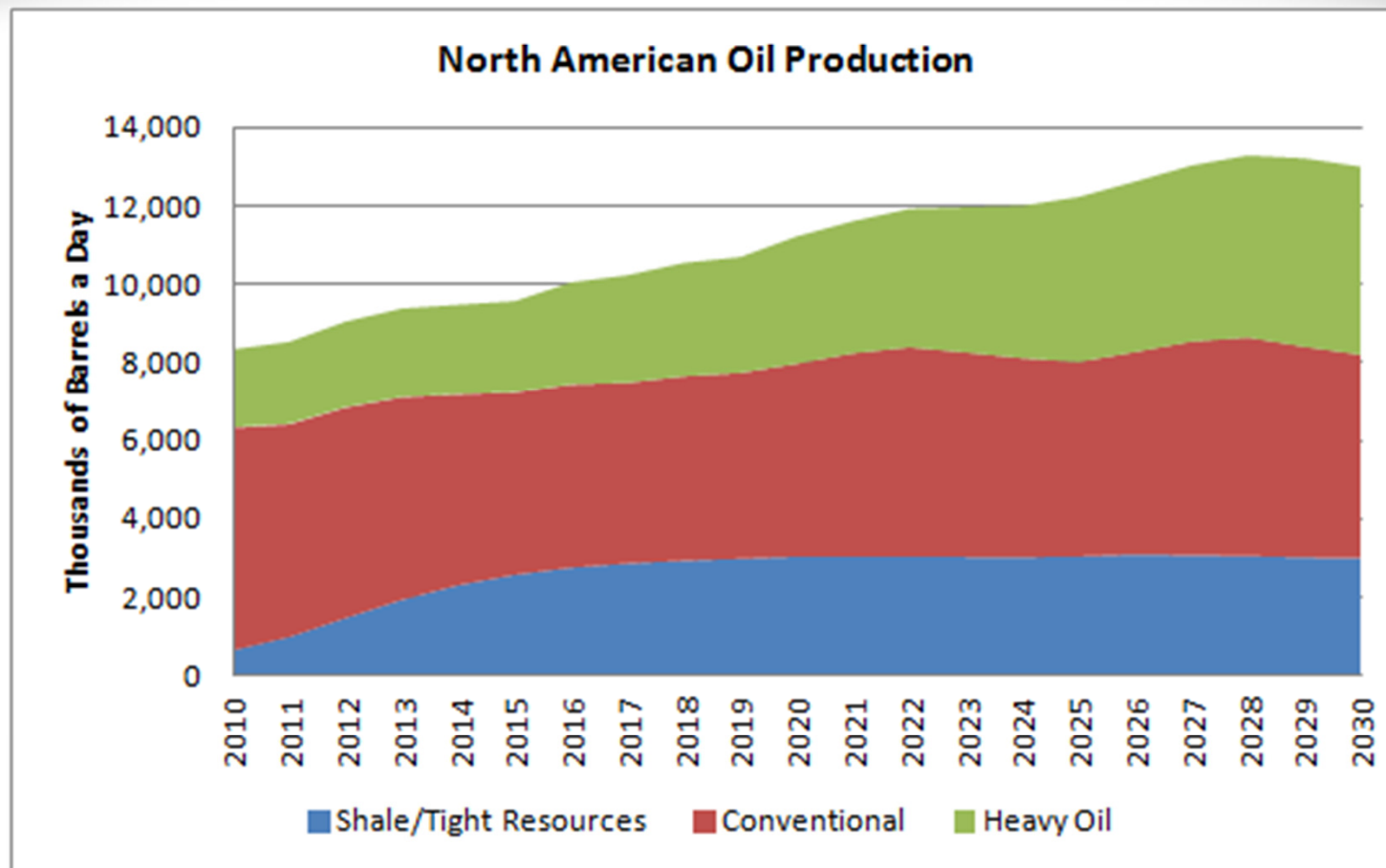
## North American Liquids-Rich Plays



Sources: Rystad Energy in partnership with Hart Energy

# Impact on Prices Drives Shift to Liquids

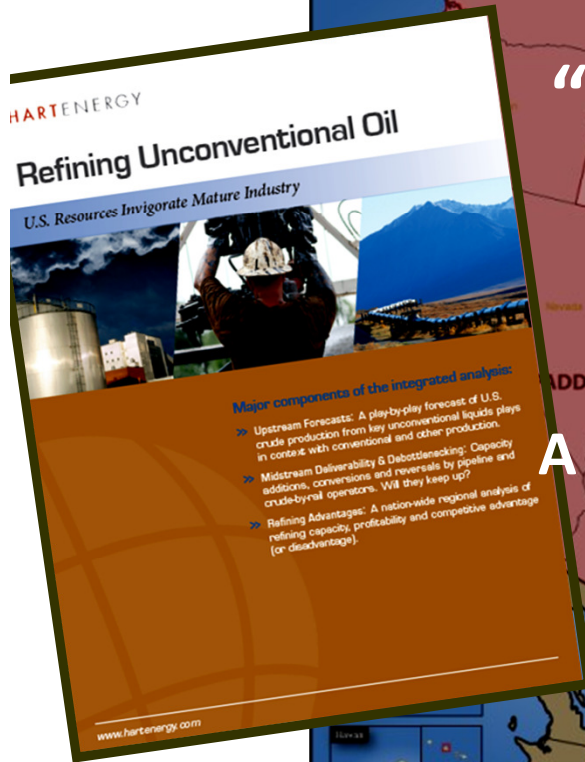
## North American Liquids-Rich Plays



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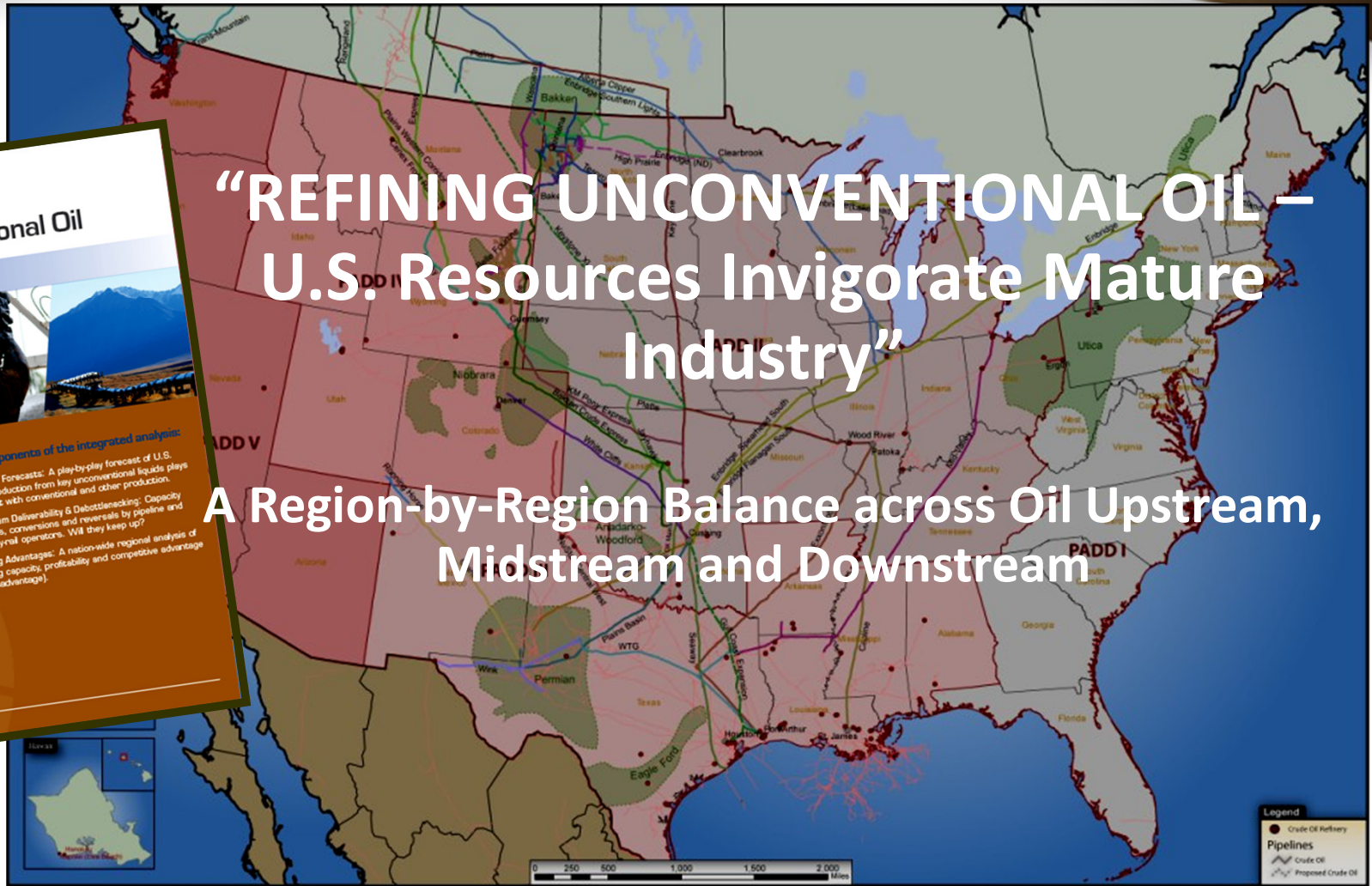
# Impact on Prices Drives Shift to Liquids

## The Latest Intelligence from Hart Energy Research



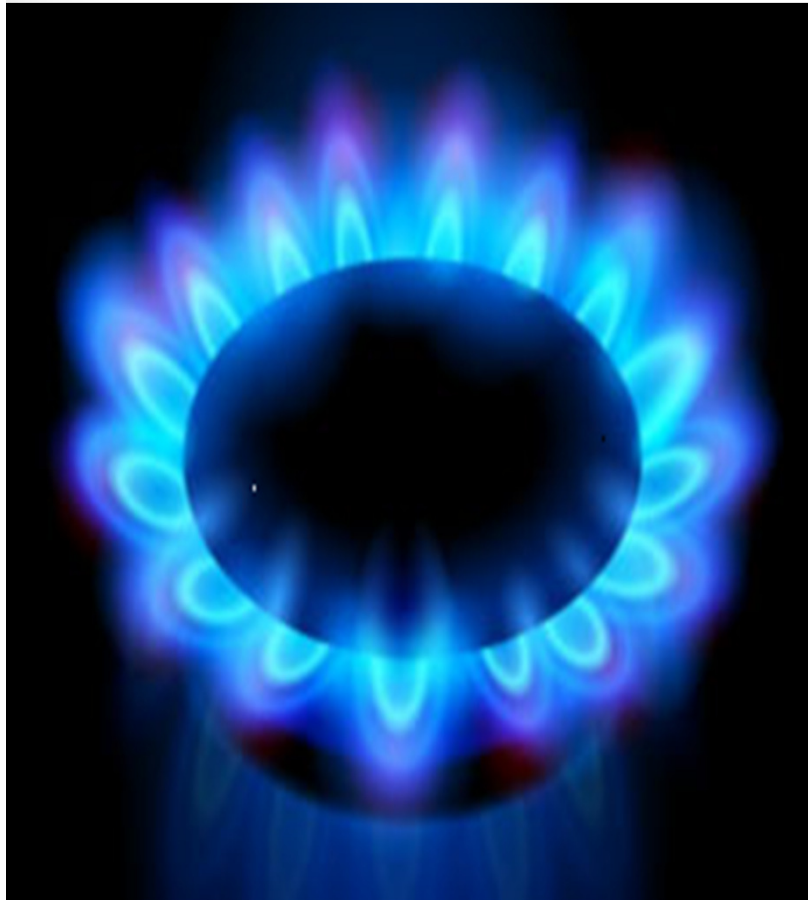
“REFINING UNCONVENTIONAL OIL –  
U.S. Resources Invigorate Mature  
Industry”

A Region-by-Region Balance across Oil Upstream,  
Midstream and Downstream



# Takeaways

# Takeaways



- Shale & tight resources have restructured American oil & gas, and industry as a whole
- Technology is key
- Exports? Transportation?
- Advantaged end user gas costs
- Oil and liquids rich activity rising
- Enabling to better energy security at lower costs



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