



Proof of Concept and Challenges: U.S. Natural Gas



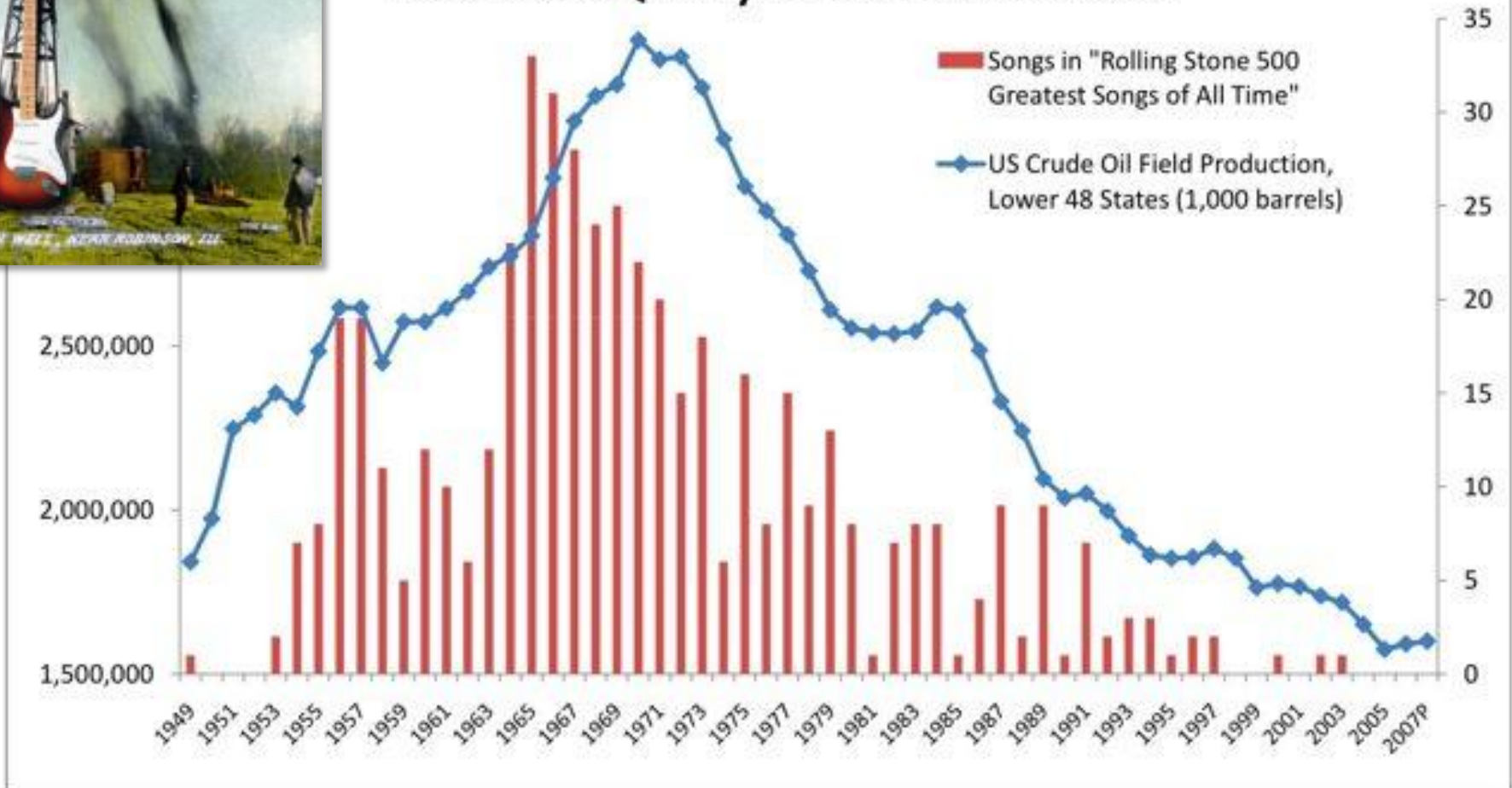
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2012 Summer Seminar
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On a lighter note...



Rock Music Quality vs. US Oil Production



U.S. Oil and Gas Today



The turnaround in production:

- Challenges “peak oil” and “peak gas”
- Pushed NG price lower, undermining climate, green energy politics
- Contributed real economic benefits and returns to the economies of host states (Texas, North Dakota, etc.) and the U.S.
- Inspired potential new scenarios for U.S. energy security and international geopolitics

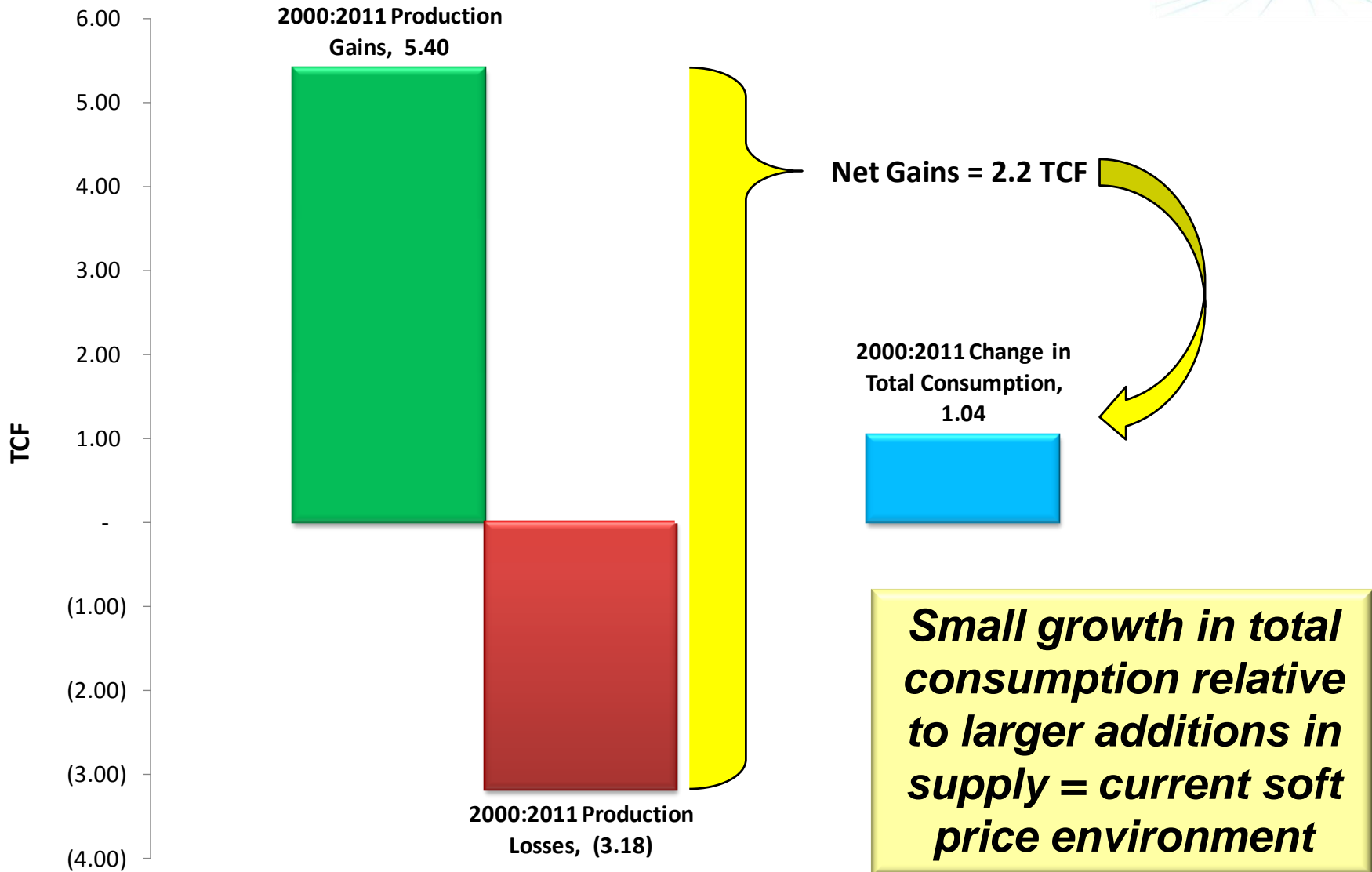
Success Breeds New Concerns



Economic/commercial risks and uncertainties:

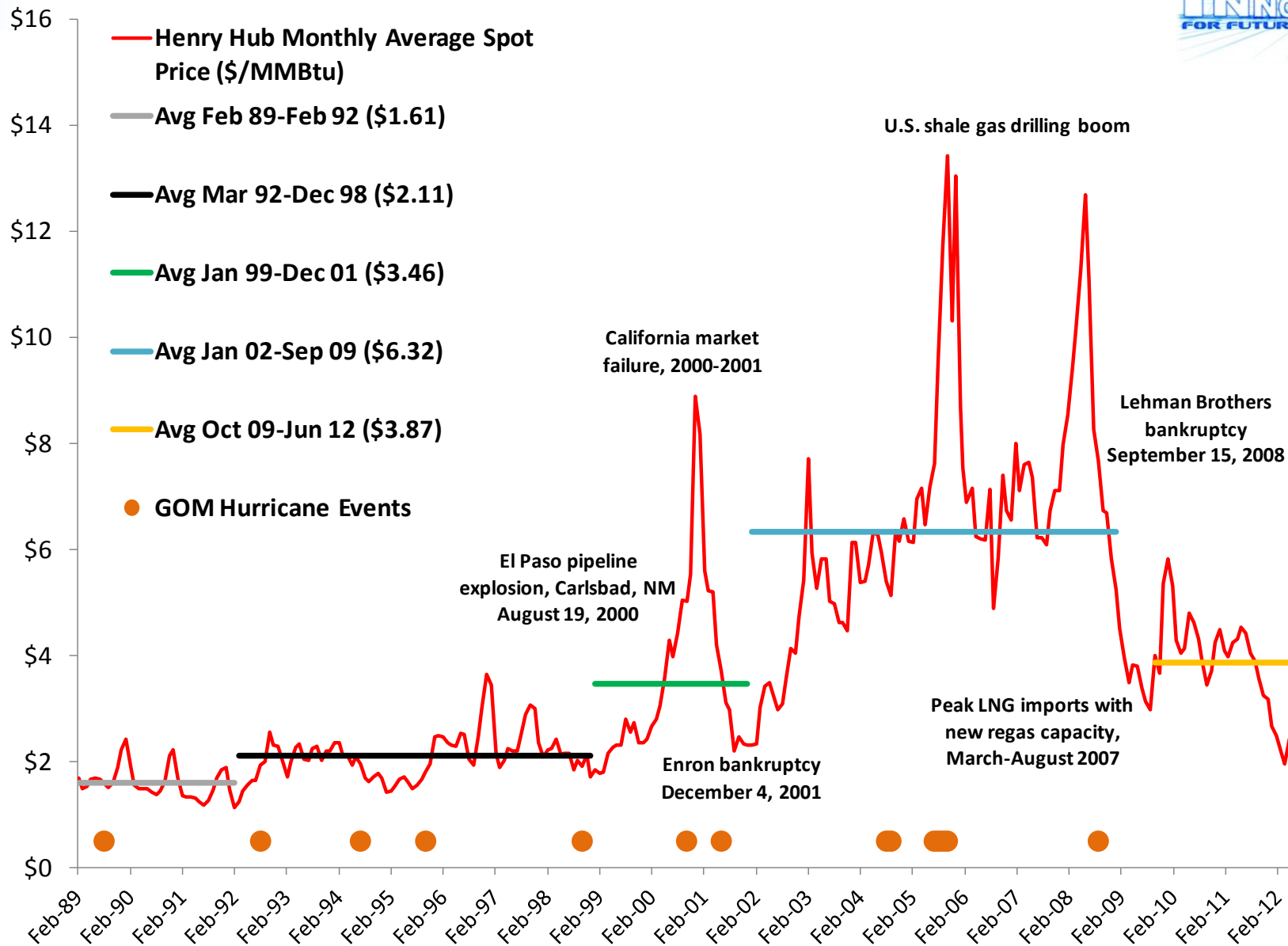
- Sustainability of U.S. unconventional nonassociated gas plays at low NG prices
- Increasing complexity in production stream
 - Oil, NGLs are **higher value targets** for drilling and production, but are oil price sensitive (WTI/Brent)
 - **Average associated gas yield** is about 20% of marketed production, potential increase probably limited to 30%
 - We balance with **nonassociated (dry) gas**, which must be replaced; drilling is sensitive to NG price (Henry Hub)
- Longer term, NG price must rise to a level that can support marginal cost of supply, given demand
 - ***Growth transition with implications for outlooks***

Gains in Production > Consumption



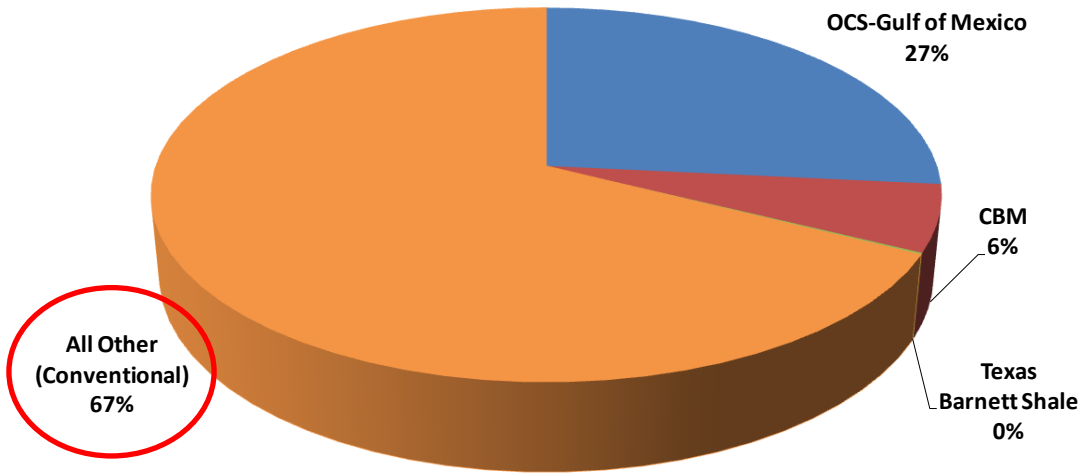
EIA, U.S. marketed production, CEE analysis

Price Eras and Drivers



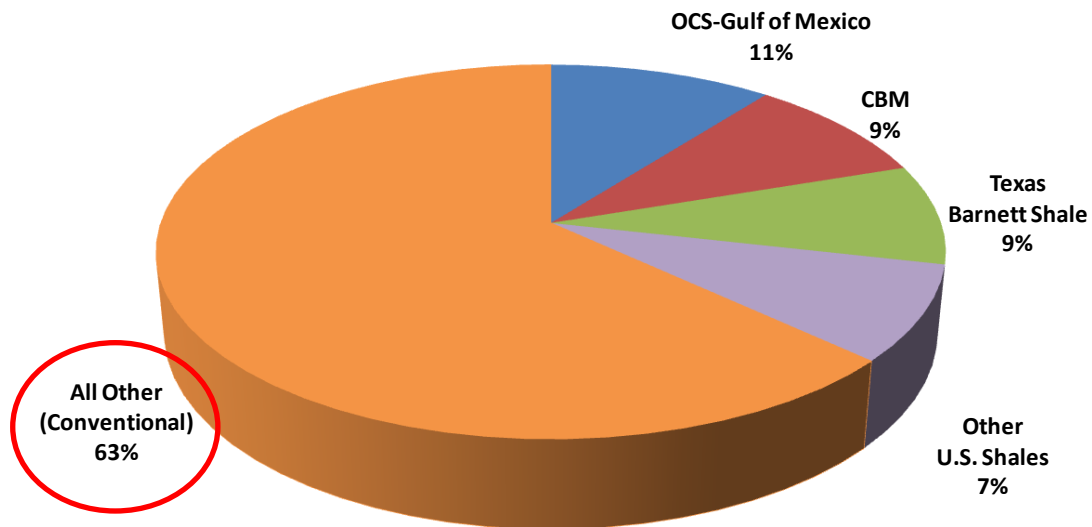
CME, USEIA, CEE

Location, Location, Location



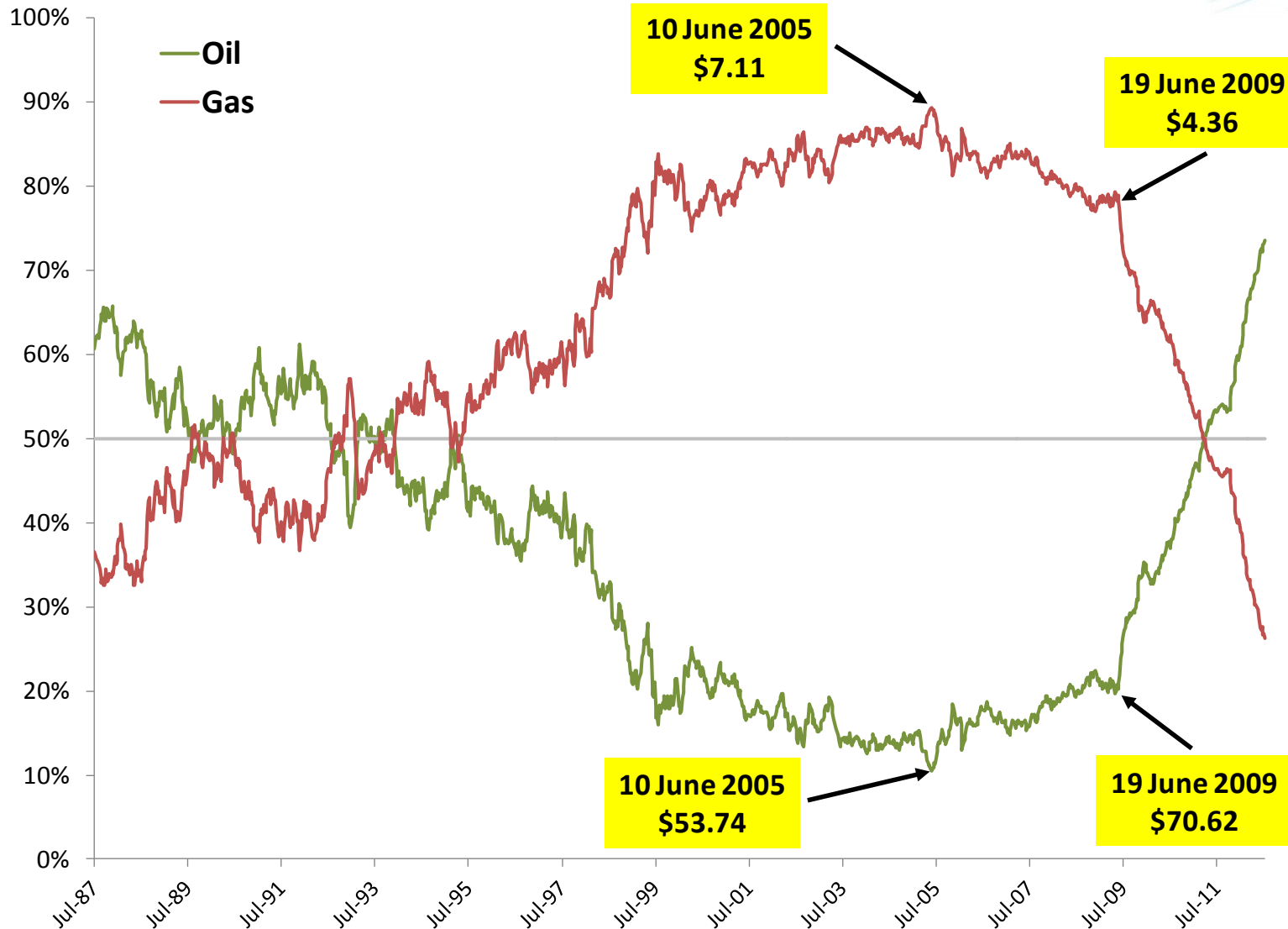
1997 Shares

2010 Shares



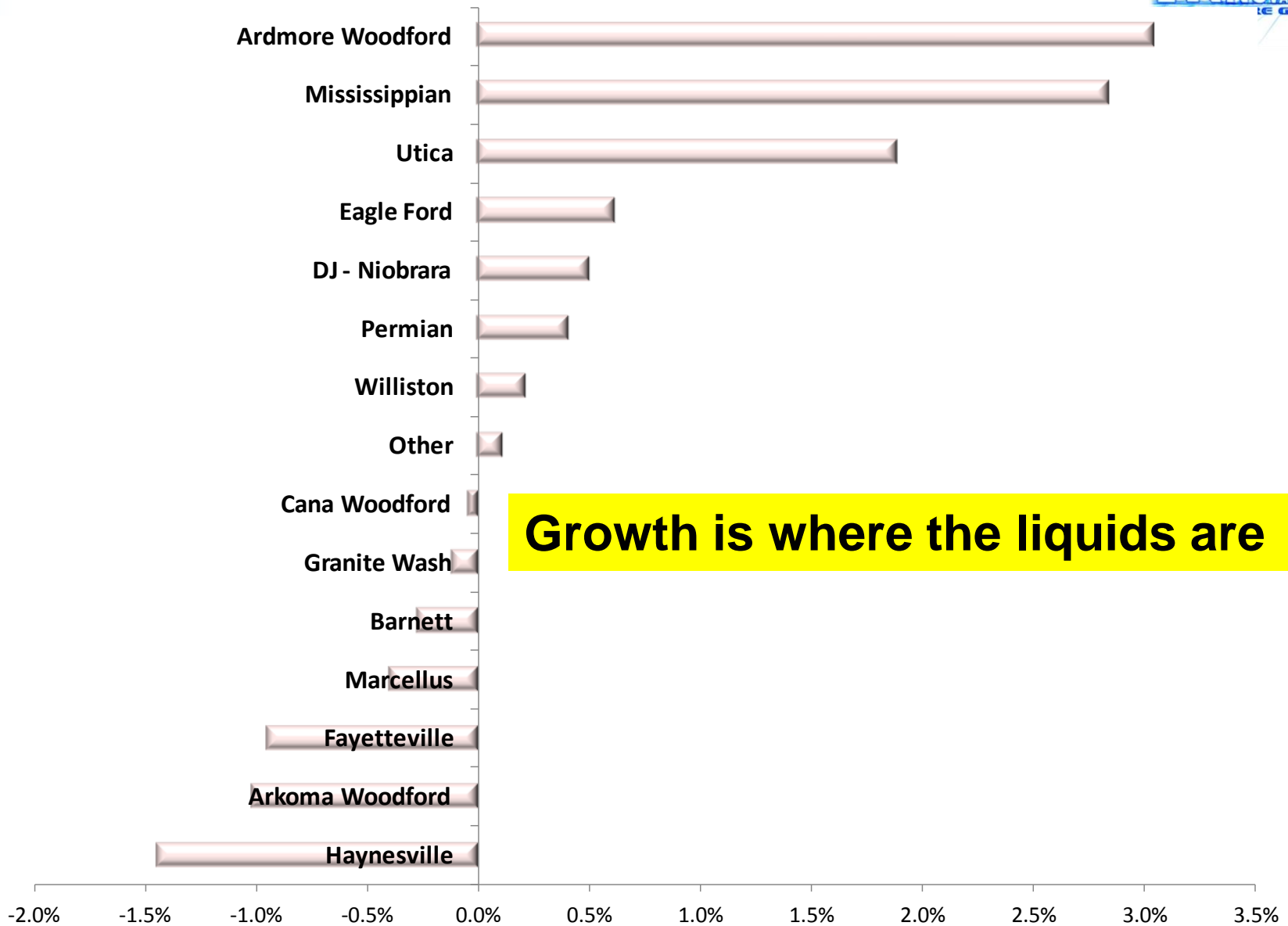
EIA, CEE

The Dash for Oil



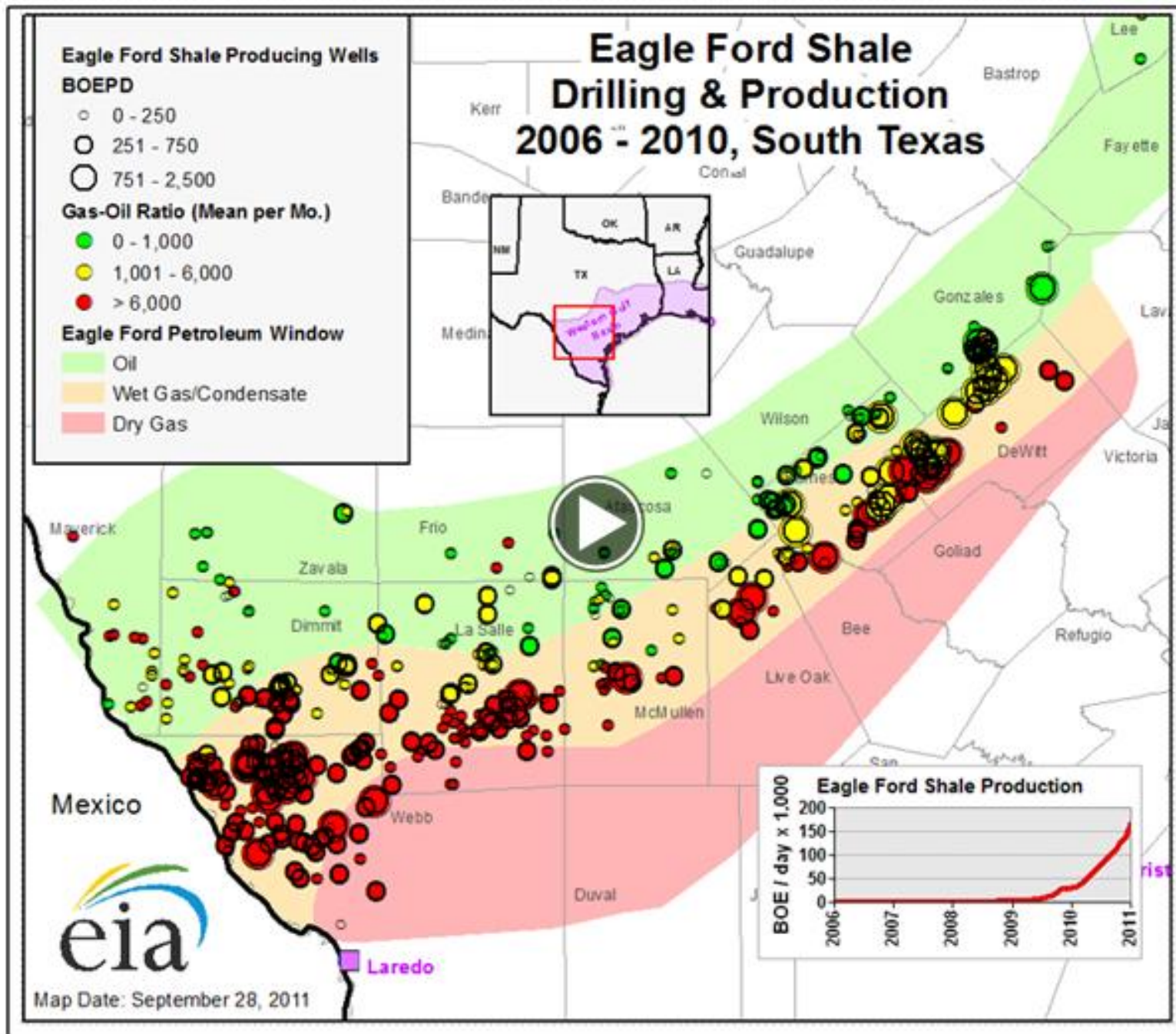
Baker Hughes, EIA/CME

Drilling Activity Trends, Feb 11-Jun 12



Growth is where the liquids are

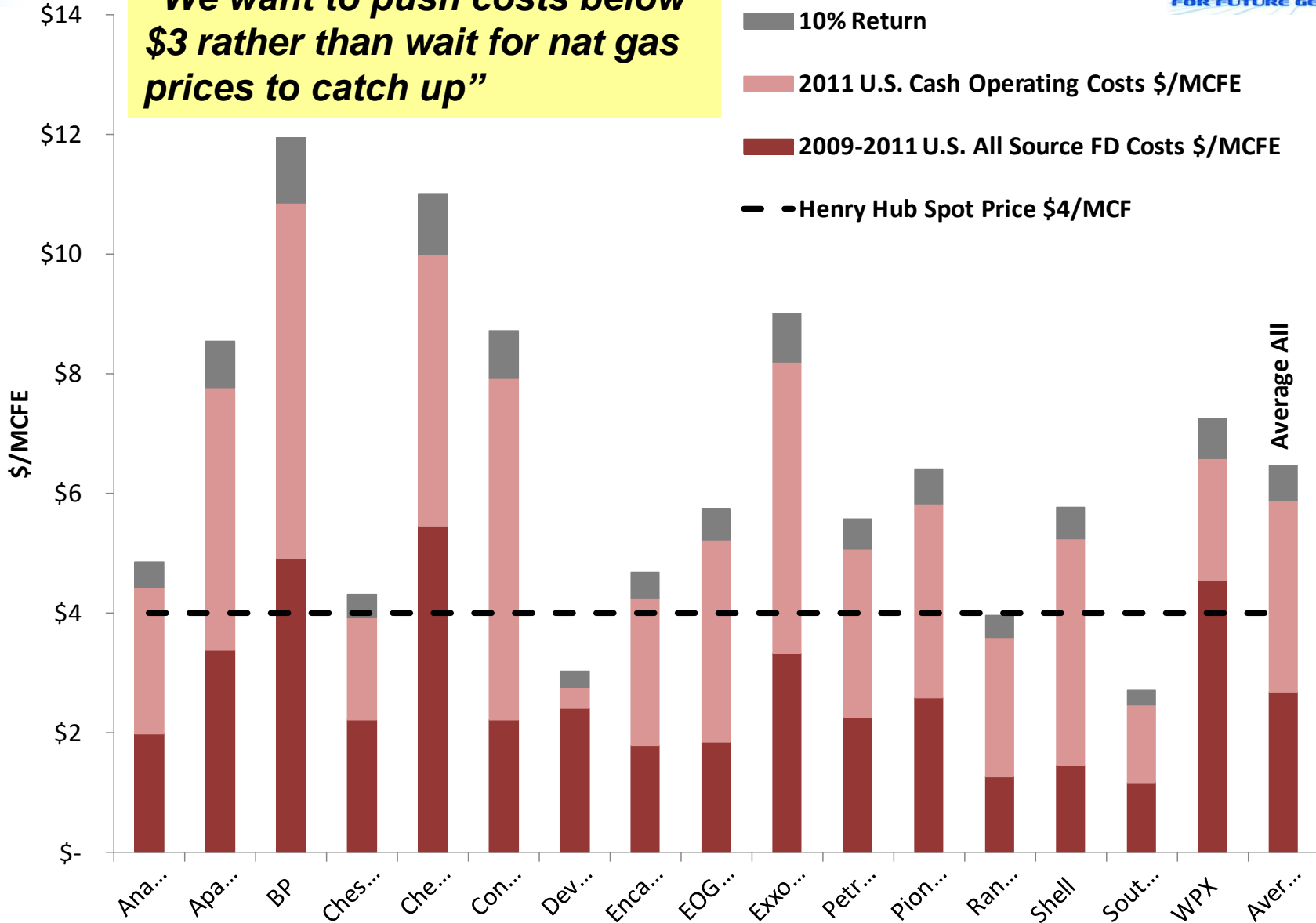
Baker Hughes, CEE



Commercial Recoverability is Key

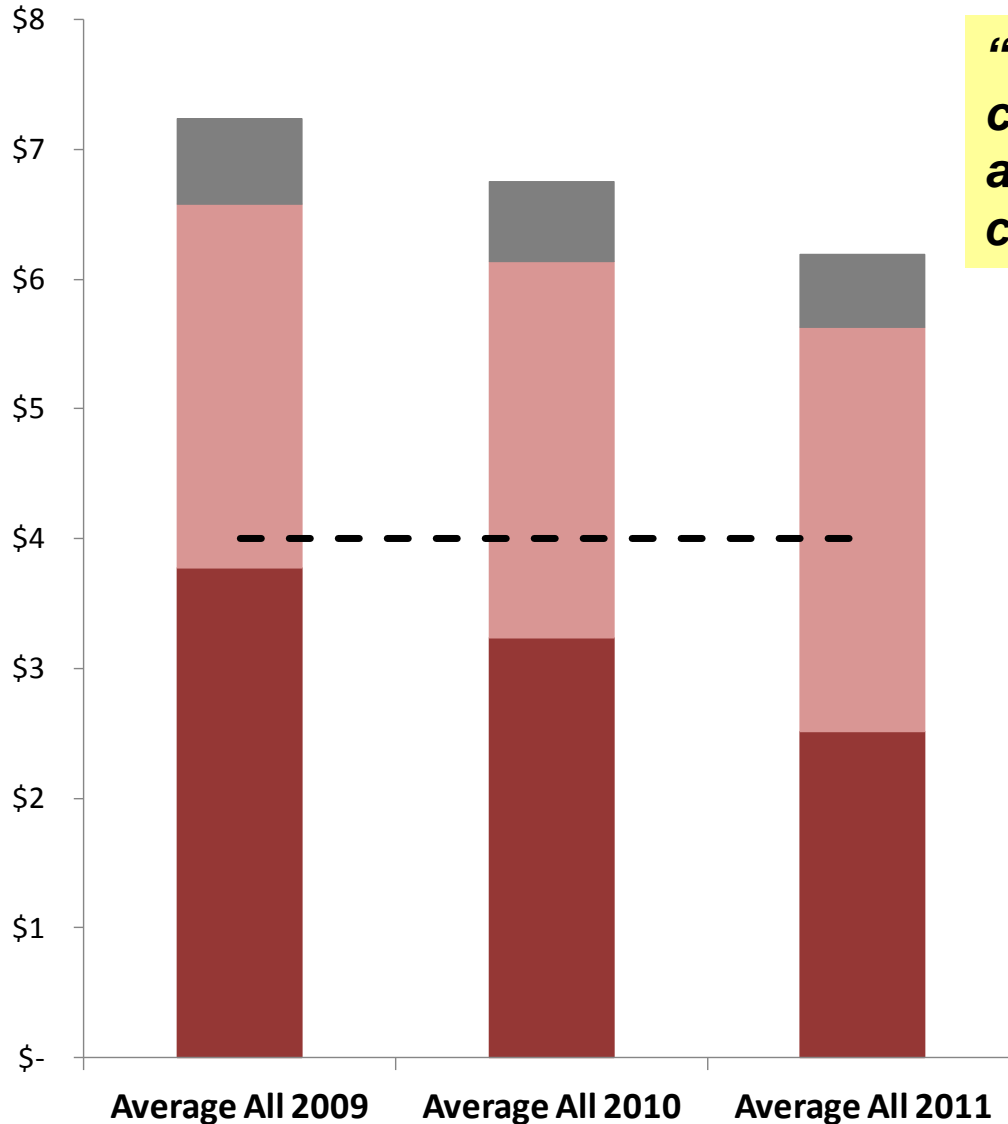


“We want to push costs below \$3 rather than wait for nat gas prices to catch up”



Industry financials, CEE

Reductions in FD Capex but Cash Costs Continue to Grow



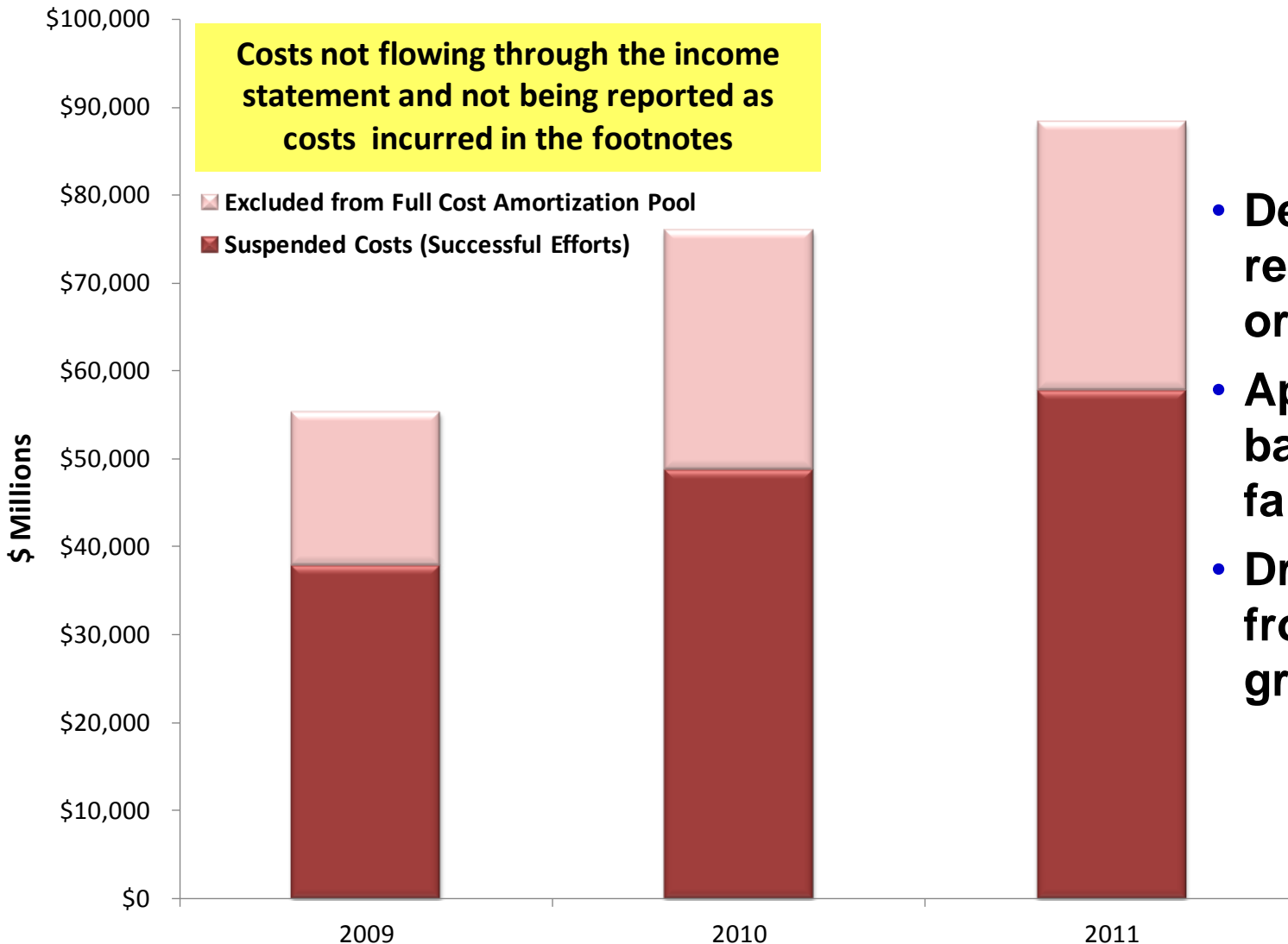
“Exploration groups love shale – they can book a billion BOE. No one thinks about the 6,000 wells the production company has to drill.”

- 10% Return
- U.S. Cash Operating Costs \$/MCFE
- U.S. All Source FD Costs \$/MCFE
- Henry Hub Spot Price \$4/MCF

- **Spending is well above CF**
- **Credit revolvers depleting**
- **Increased scrutiny for potential write downs**

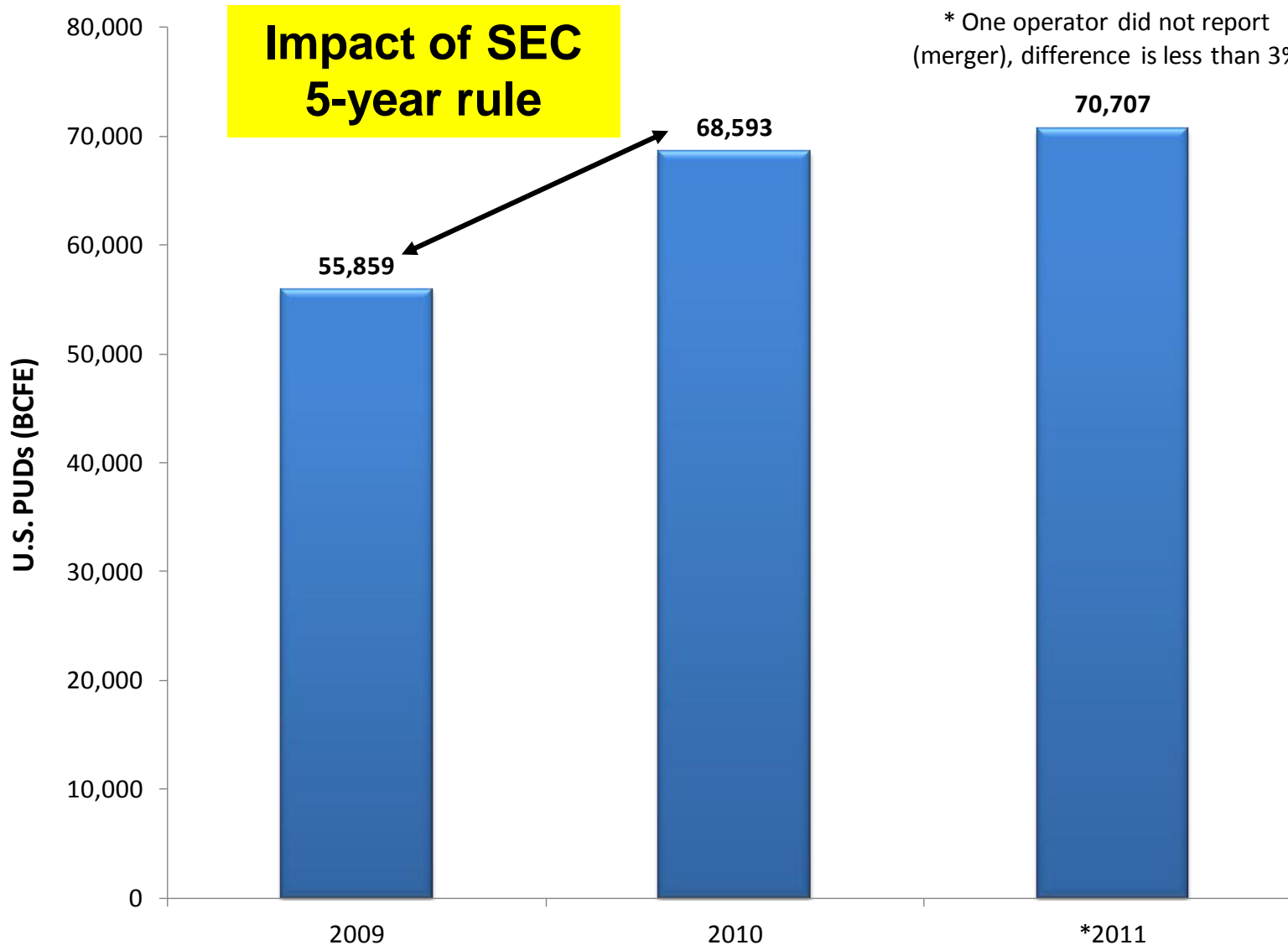
Average All 2009 Average All 2010 Average All 2011
Industry financials, CEE

Large Unexpensed, Uncapitalized Costs Have Accrued...



- Delayed to match reserve additions or revenues
- Appear to have ballooned with falling gas prices
- Drawing attention from ratings groups

...and PUD Bookings are Vulnerable

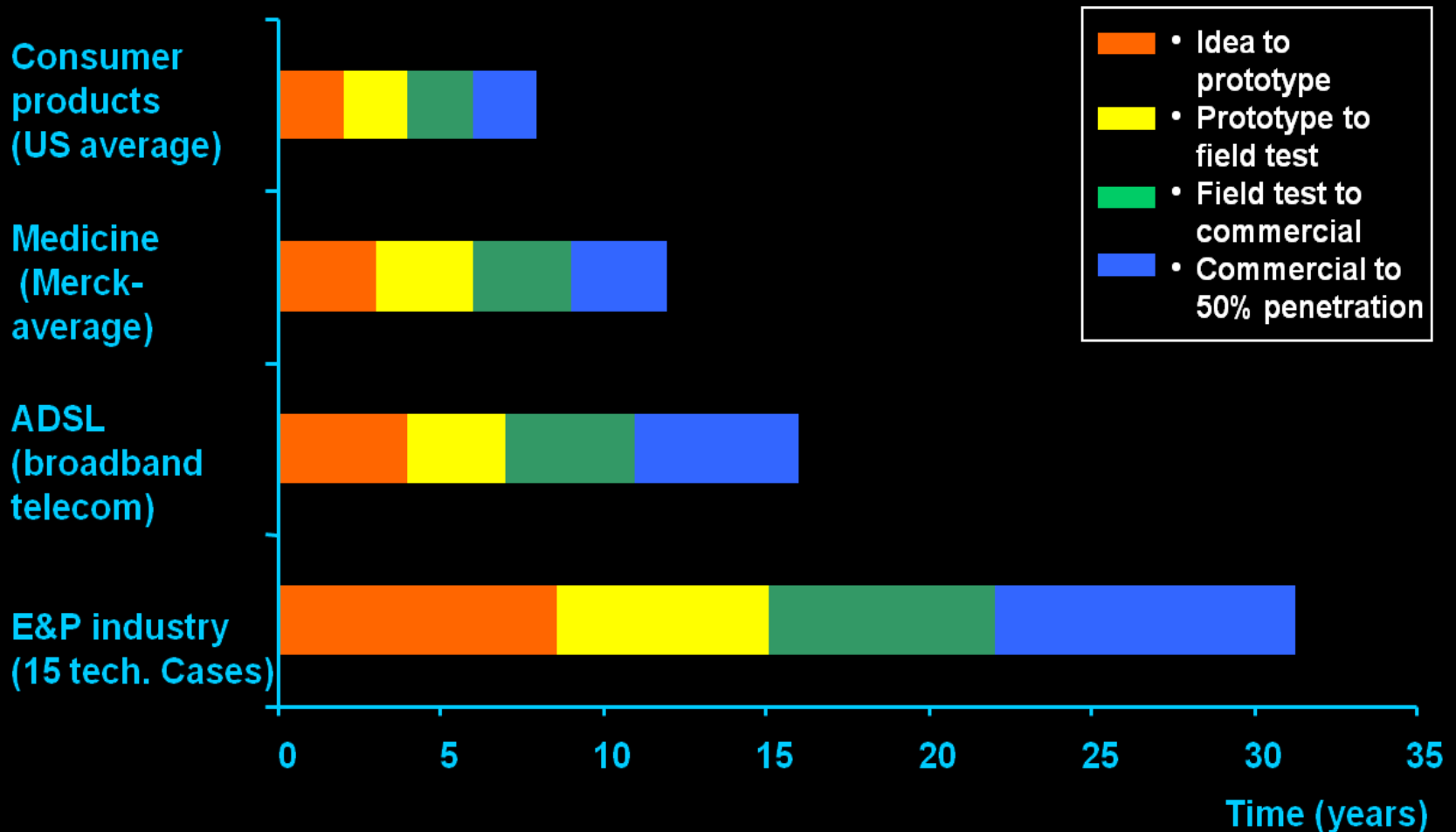


Industry financials, CEE

Perspective is Useful...

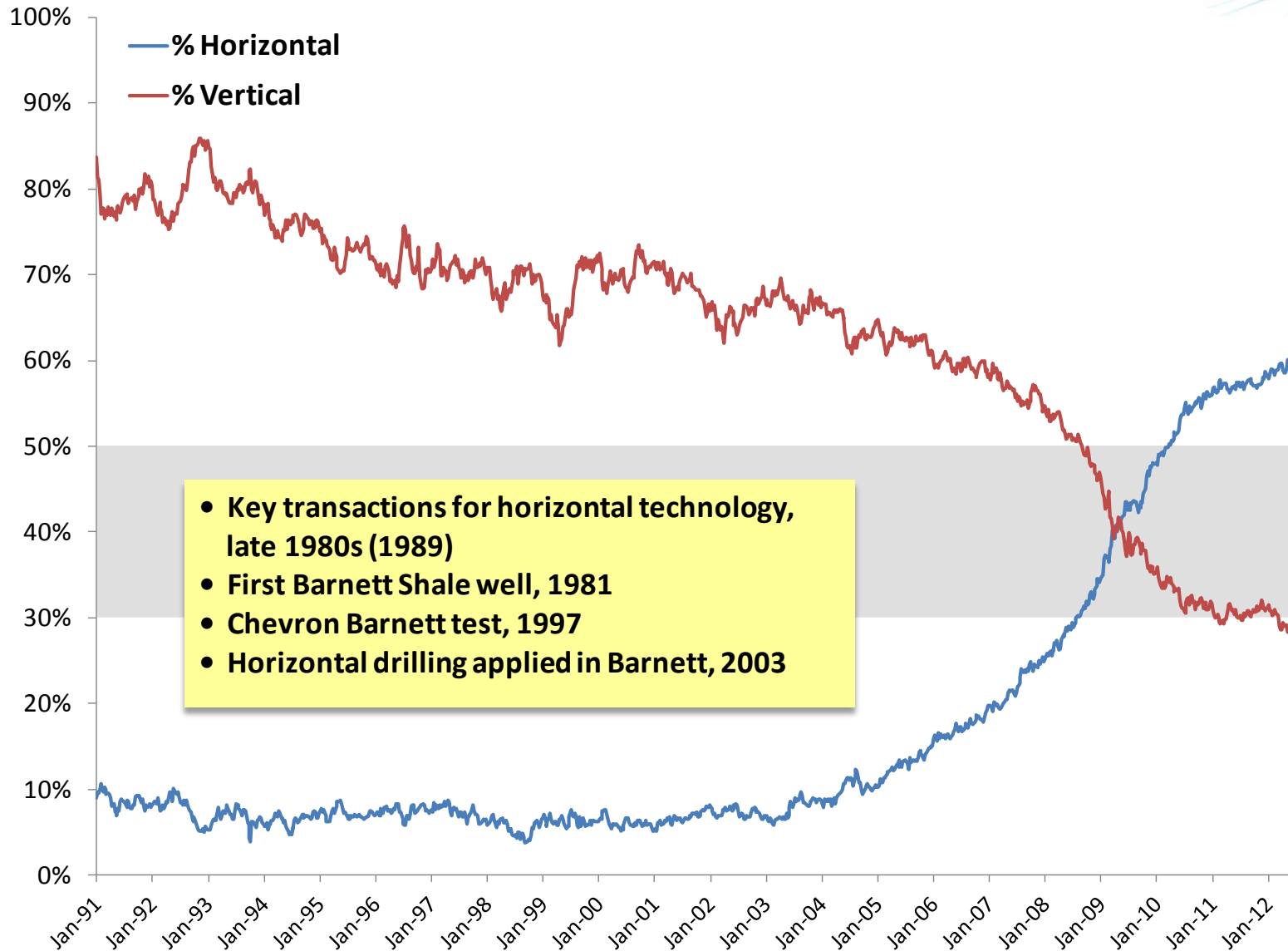


Average duration of the four phases in different industries



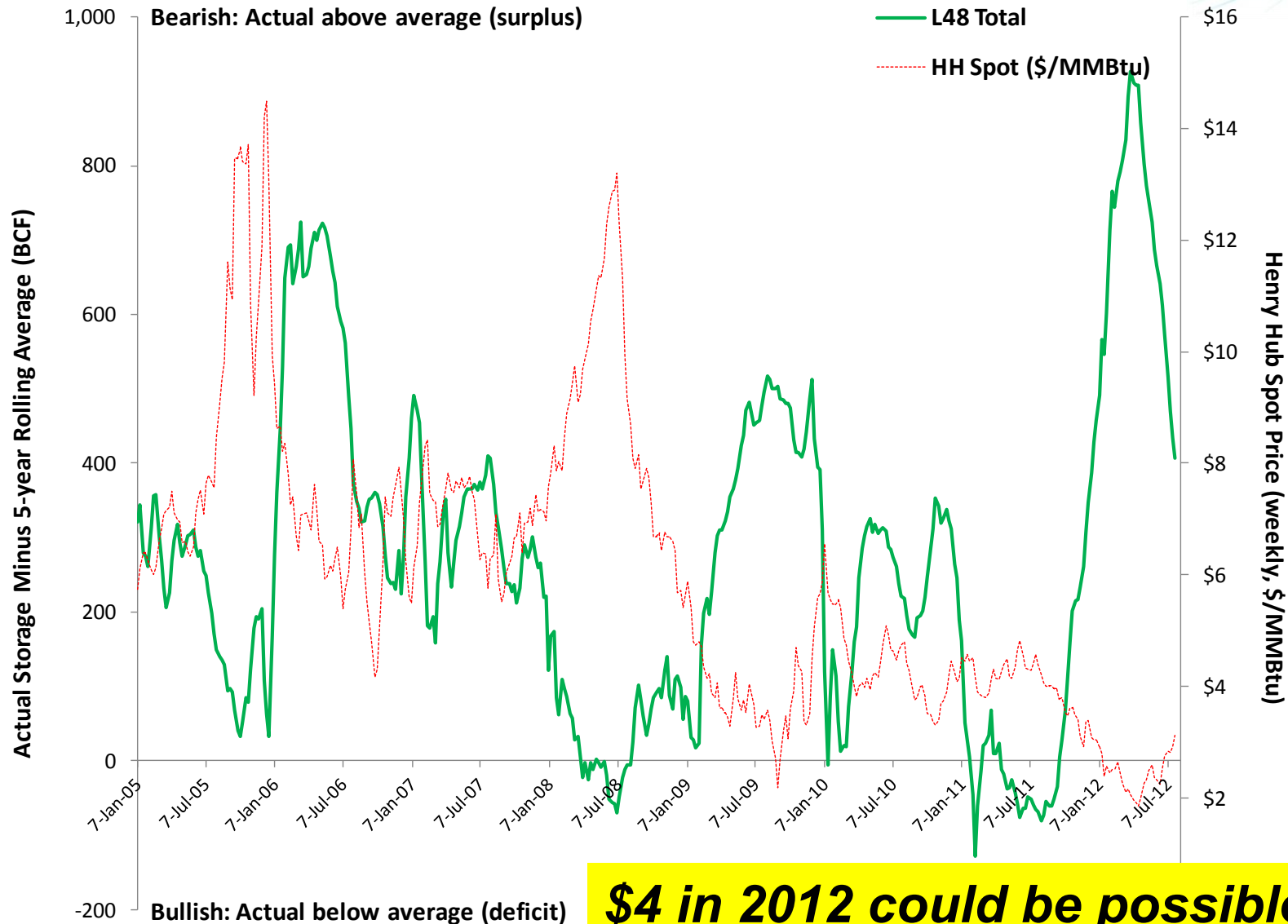
McKinsey & Company for Shell, 2001 NPC Study

...Because Oil and Gas Technology is Slow



Baker Hughes

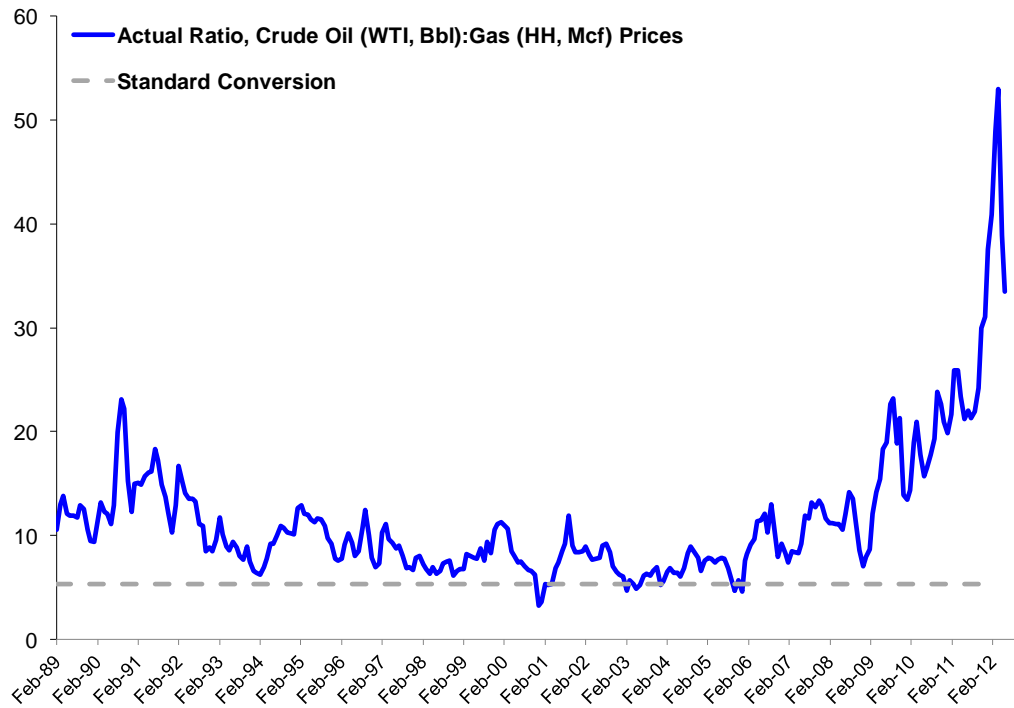
Short Run: Weather; Producer Discipline



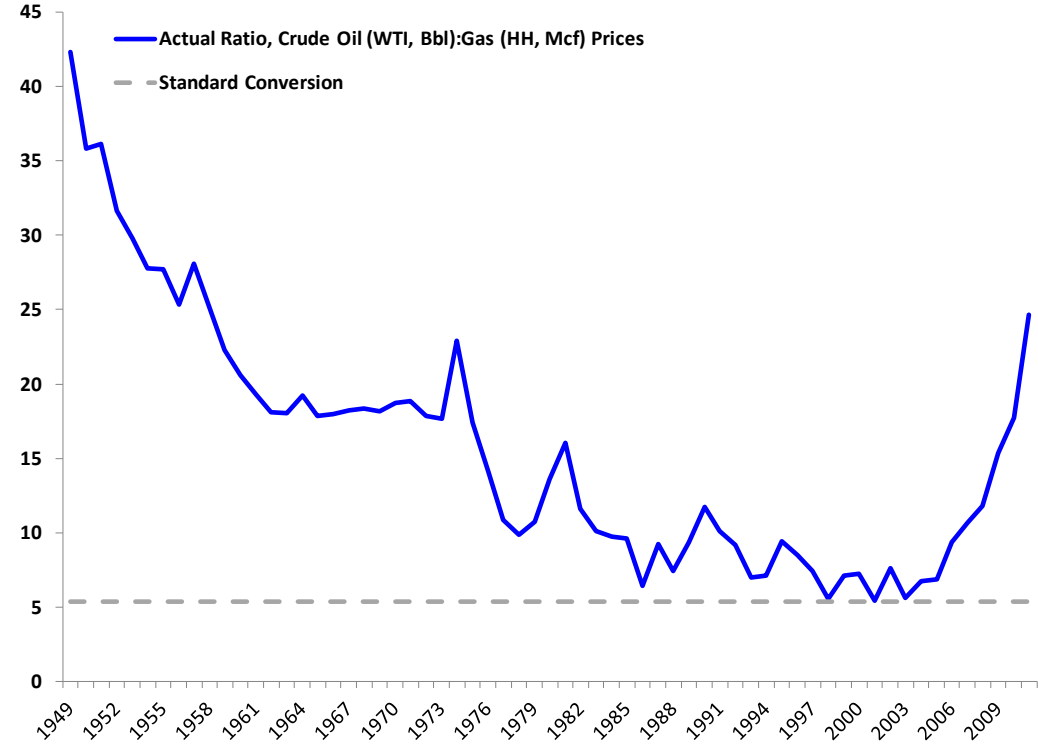
EIA, CME, CEE



Will Oil:Gas Price Spreads Persist?

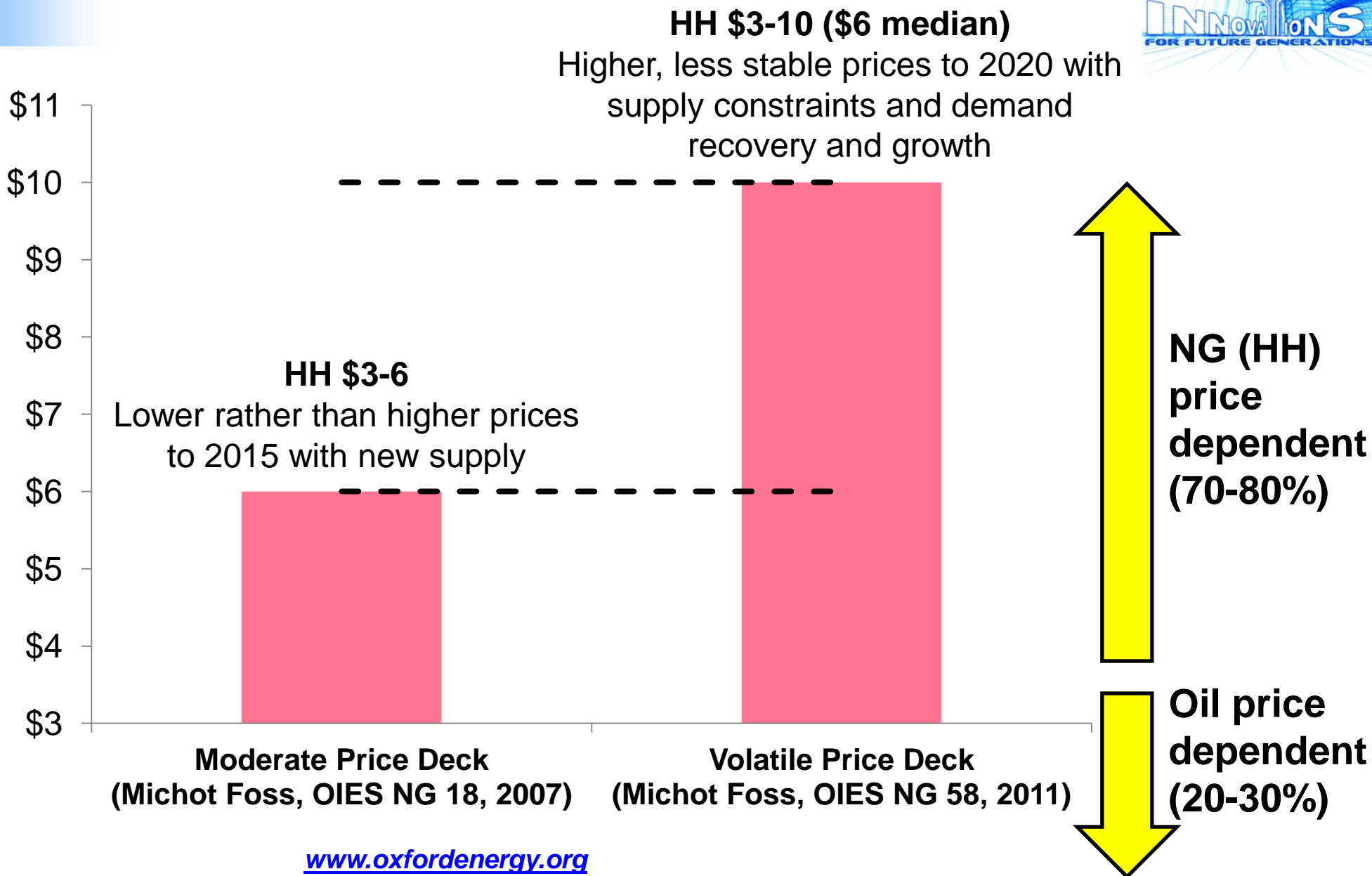


“A ‘fair’ price for gas would be at par with that of oil, Qatar’s Energy Minister Mohammed Al-Sada said.”
 – *November 15, 2011, Bloomberg*



EIA, CME, CEE

Possible Scenarios

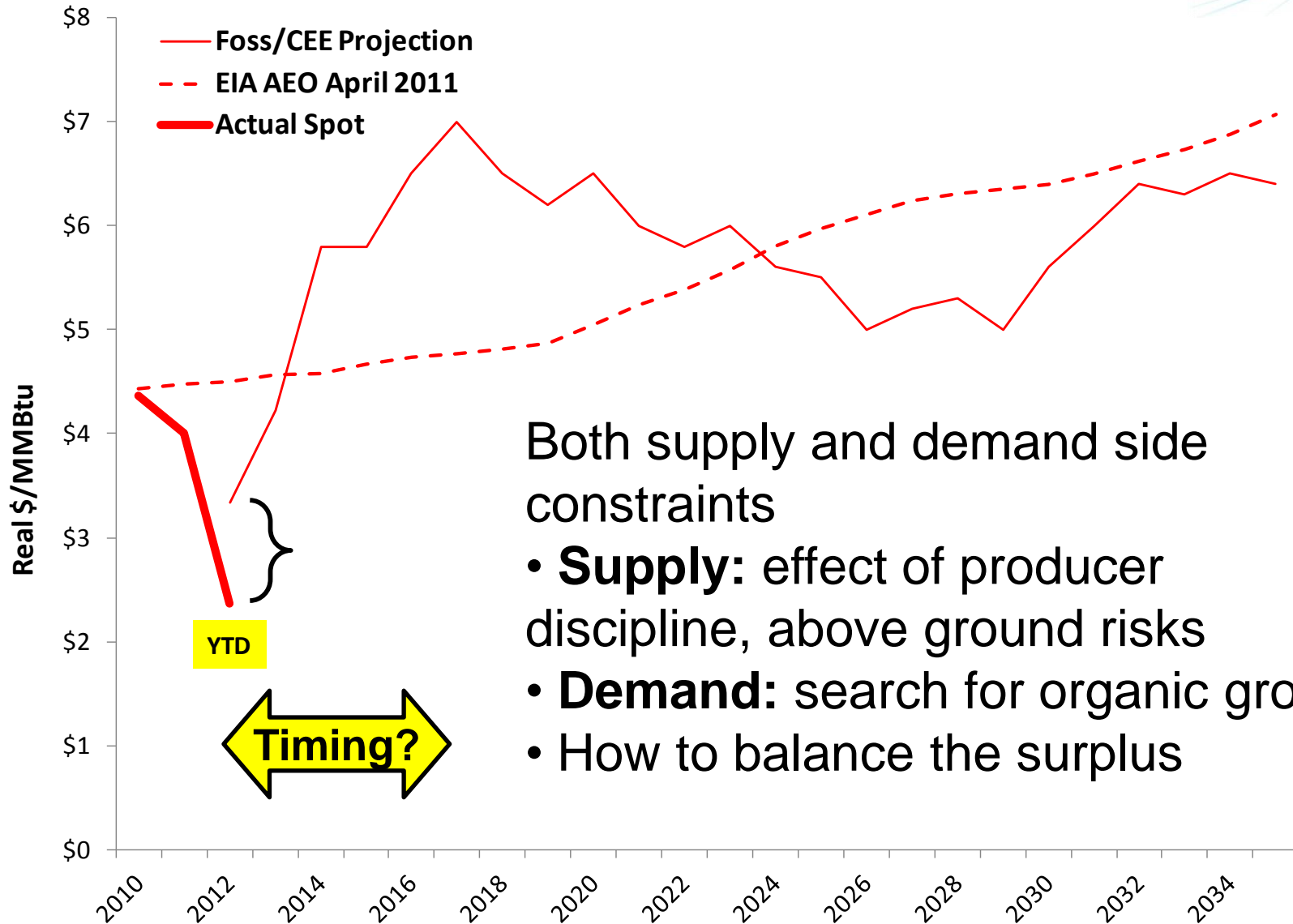


Key Drivers for Scenarios



Variable	Moderate	Volatile
Shale deliverability	Full deliverability	Reality check
Non-shale deliverability	Recovery	Declines
Policy, regulation	Favorable	Unfavorable
Economic recovery	Weaker	Stronger
Gas-fired power	Slow increase	Rapid increase
Industrial	Modest growth	Strong growth
Midstream, downstream bottlenecks	None	Many
Oil:gas spread	Wider	Narrower
Business model	“Lower price, higher volume”	“Higher price, lower volume”

A Possible Outcome



Both supply and demand side constraints

- **Supply:** effect of producer discipline, above ground risks
- **Demand:** search for organic growth
- How to balance the surplus

Bottom Line



- We have a large, rich resource endowment
- Investment was relatively easy to mobilize
 - High price signal
 - Private lands and minerals
- Conflicting conditions
 - With recession, strong supply-demand imbalance
- Upstream and midstream businesses are both in transition
- ***Does \$4 even work for incremental dry gas?***
 - Producer costs
 - Drilling shifts, oil capex competition
 - Reserves write-downs