

The Changing Energy Market Landscape

Prepared for



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Darryl W. Rogers



Agenda



- Ø **Introduction**
- Ø **Economy, Crude Prices & Petroleum Demand**
- Ø **World Crude Oil Supply**
- Ø **N.A. Crude Oil Supply & WTI Price**
- Ø **World LPG Supply & Demand**
- Ø **U.S. Shale Gas Boom**
- Ø **Summary & Conclusions**

Purvin & Gertz, Inc.

Technical, strategic and commercial advisory services for the global energy industry



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Economic Conditions and Outlook

Ø Global Economic Landscape

- § World growth is now 3.0%, 3.4%, and 3.8% for 2011-13
- § U.S. now weaker at 1.5%, 1.8% and 2.3% for 2011-13
- § FOMC is pursuing Operation Twist (\$400 billion)

Ø Risk to demand growth is mostly in the OECD

- § Consumer spending – trade impacts, when will it recover?
- § Employment – political response, pace and direction?
- § Greek default / European bank exposures – timing, extent, priced-in?
- § Probabilities for a second recession have increased to 40%

Ø Global petroleum demand driven by non-OECD factors

- § Asia/Pac (ex Japan) GDP outlook is still holding to 6.8% for 2011-12
- § Non-OECD accounts for essentially all of the global petroleum demand growth

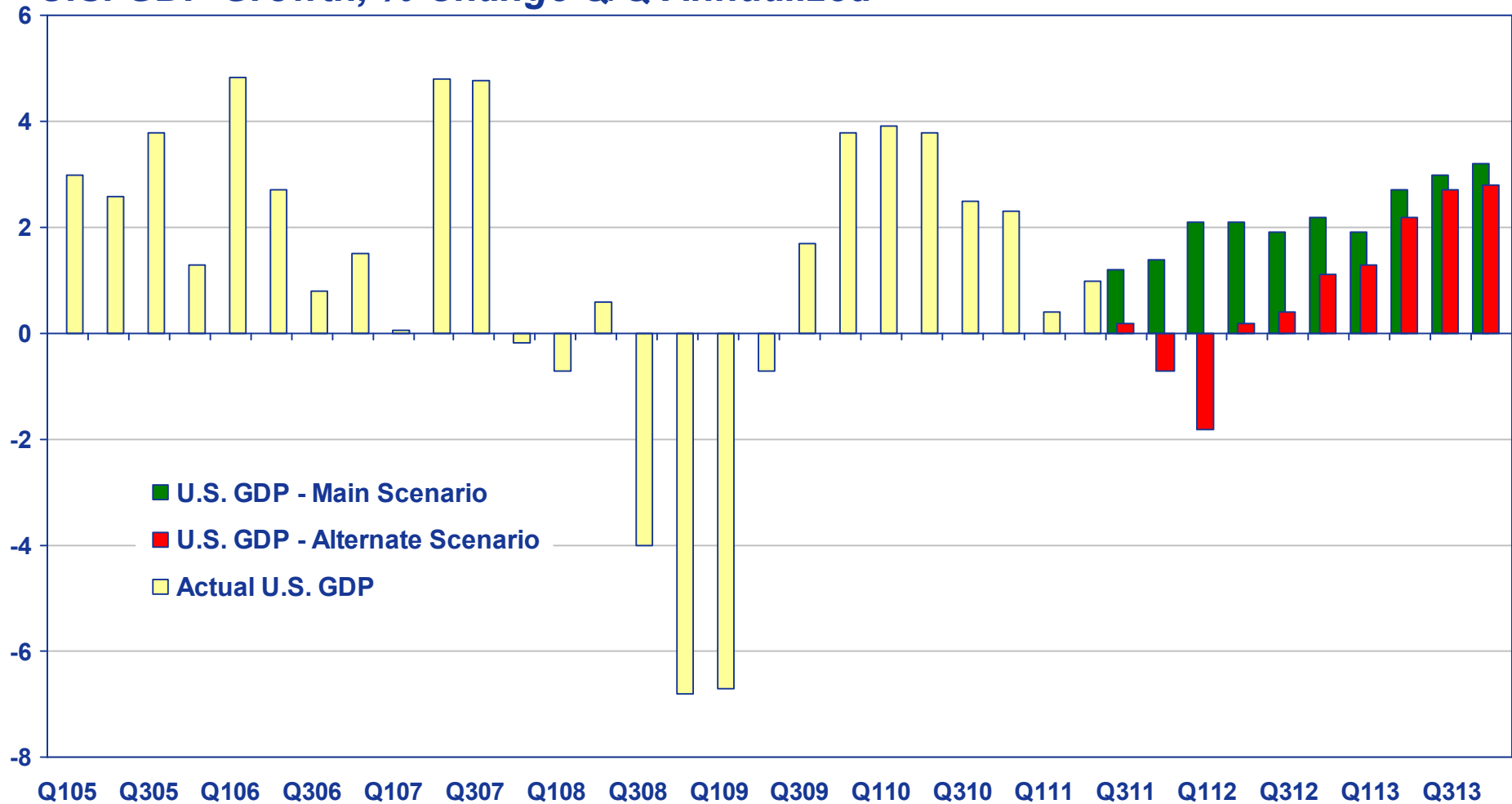
Ø How is non-OECD growth impacted by the slowing OECD economies?

- § Can China/others re-stimulate global recovery as happened in 2009?

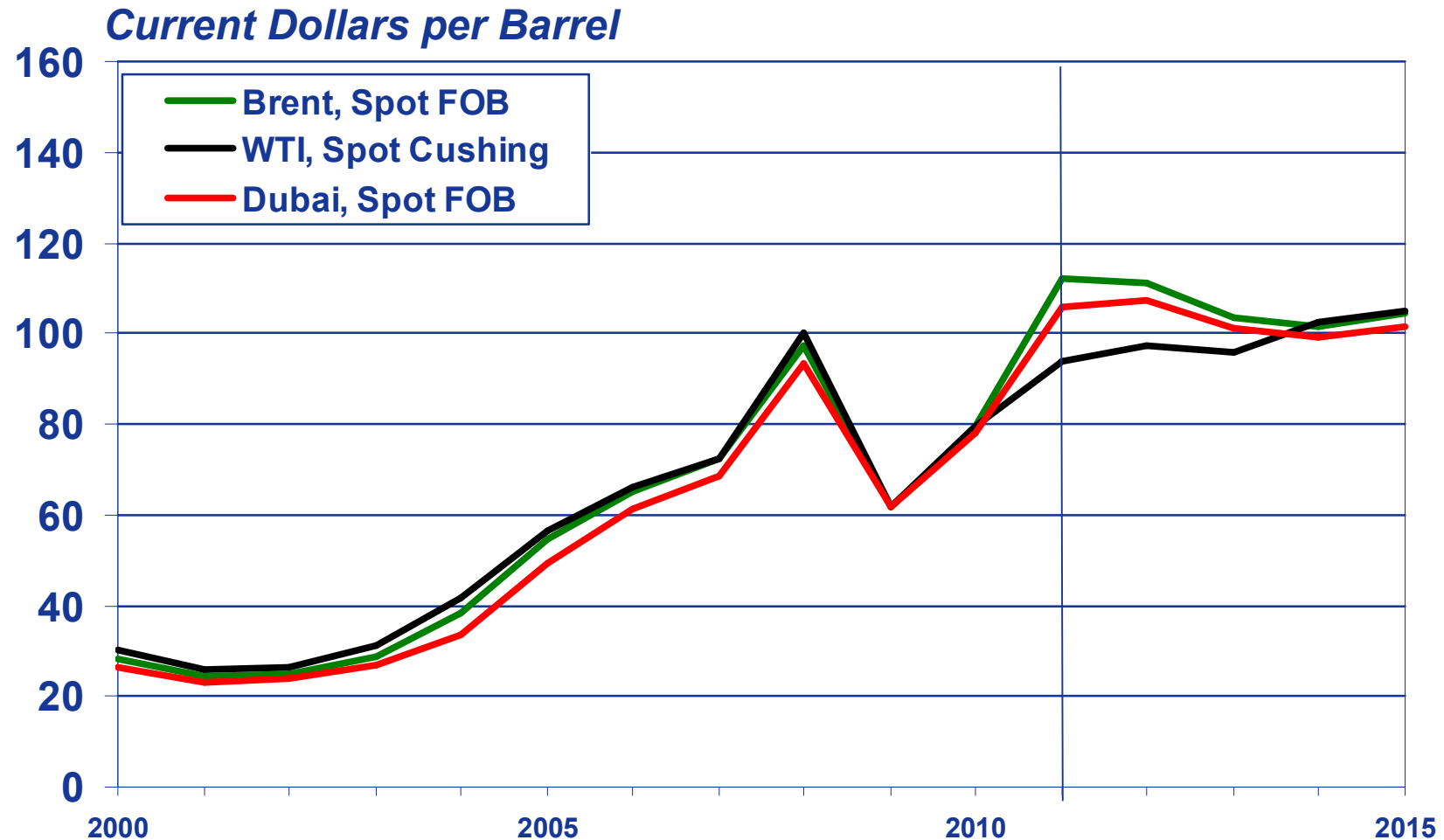
U.S. GDP Outlook

(2011 at 1.5%, 2012 at 1.8%, 2013 at 2.3%)

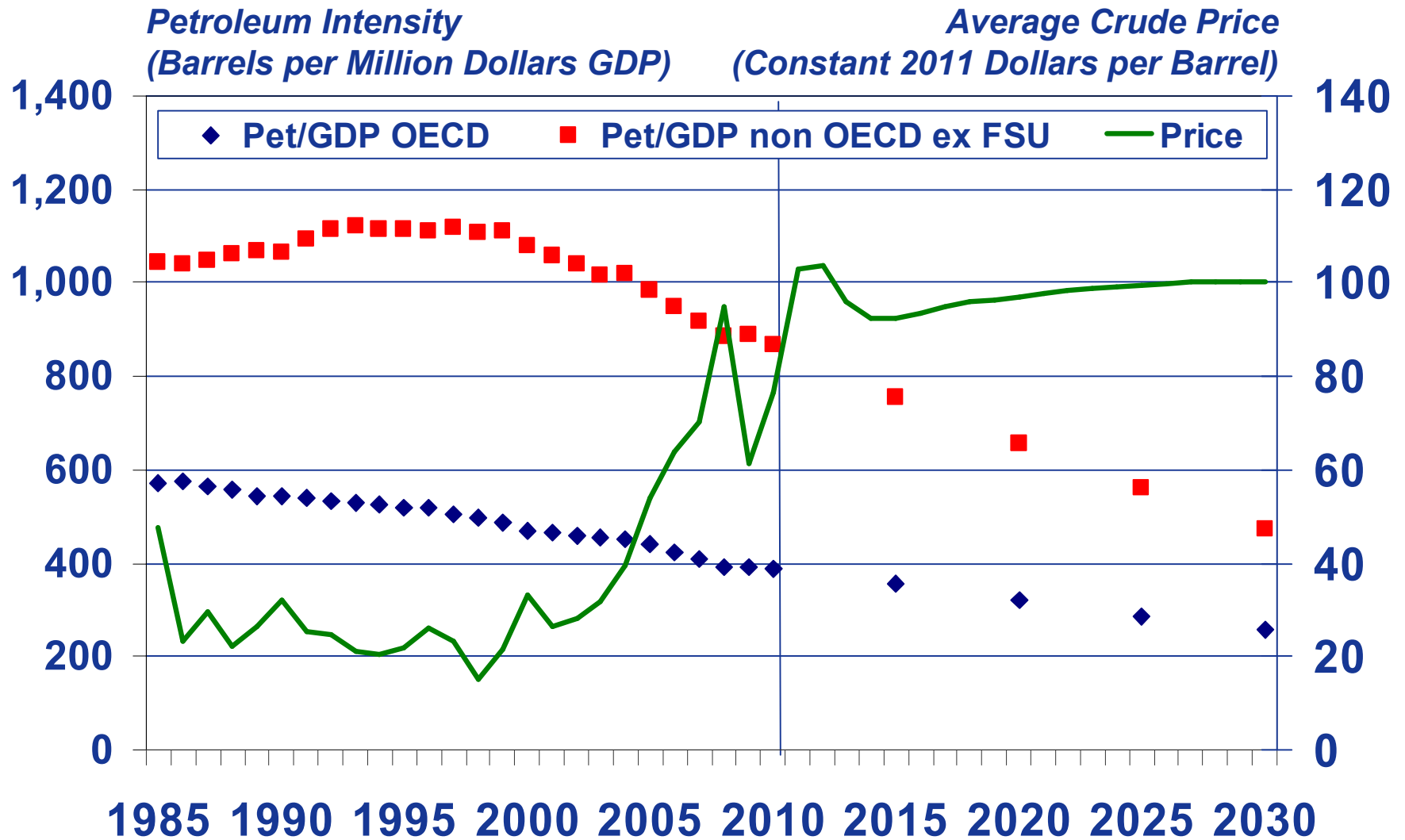
U.S. GDP Growth, % Change Q/Q Annualized



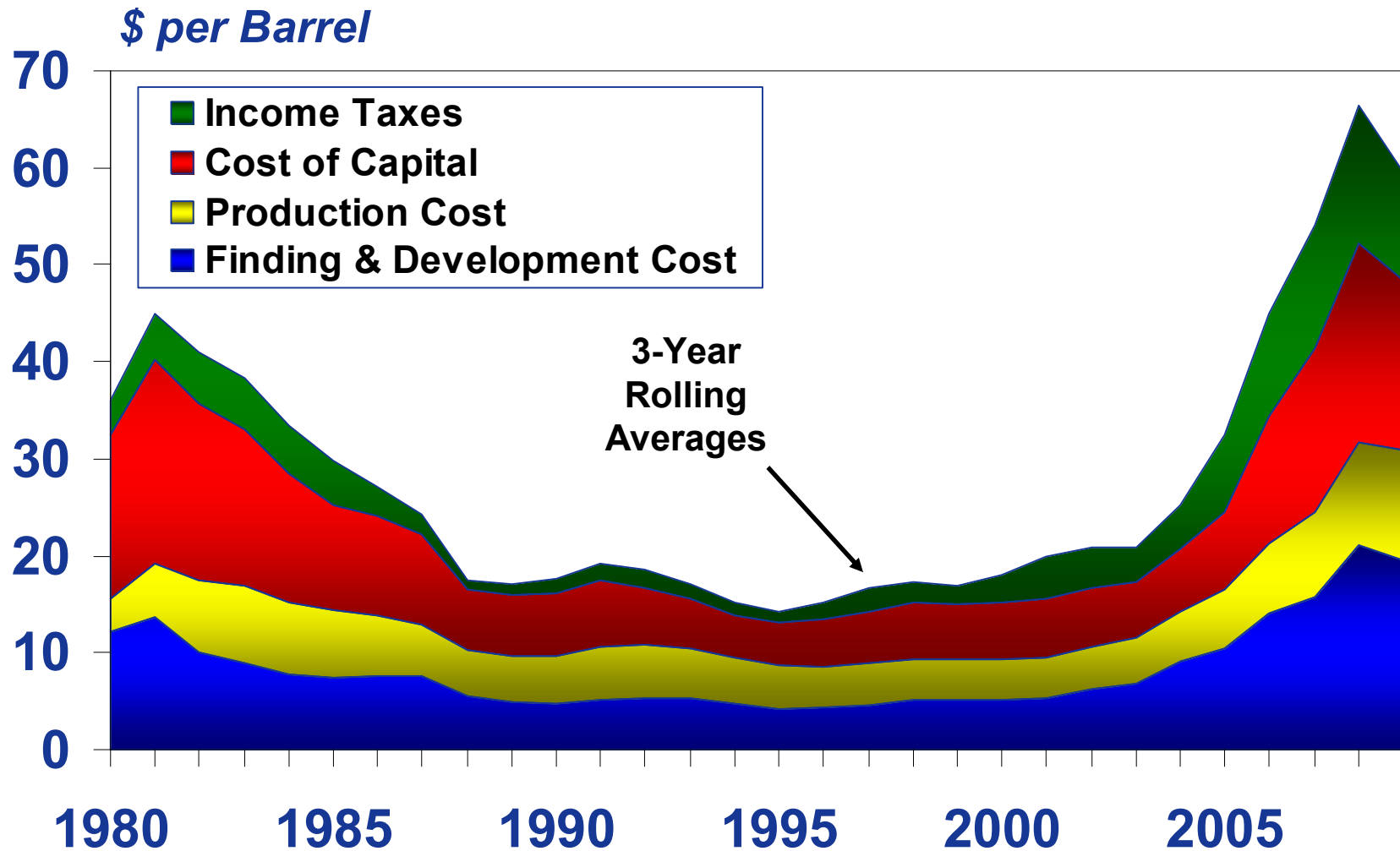
Crude Prices Have Corrected Post Credit Crisis & Recession (Slow Economic Growth And A Correction Is Expected)



Higher Price Track Required To Increase Consumption Efficiency In Both Emerging And Mature Markets

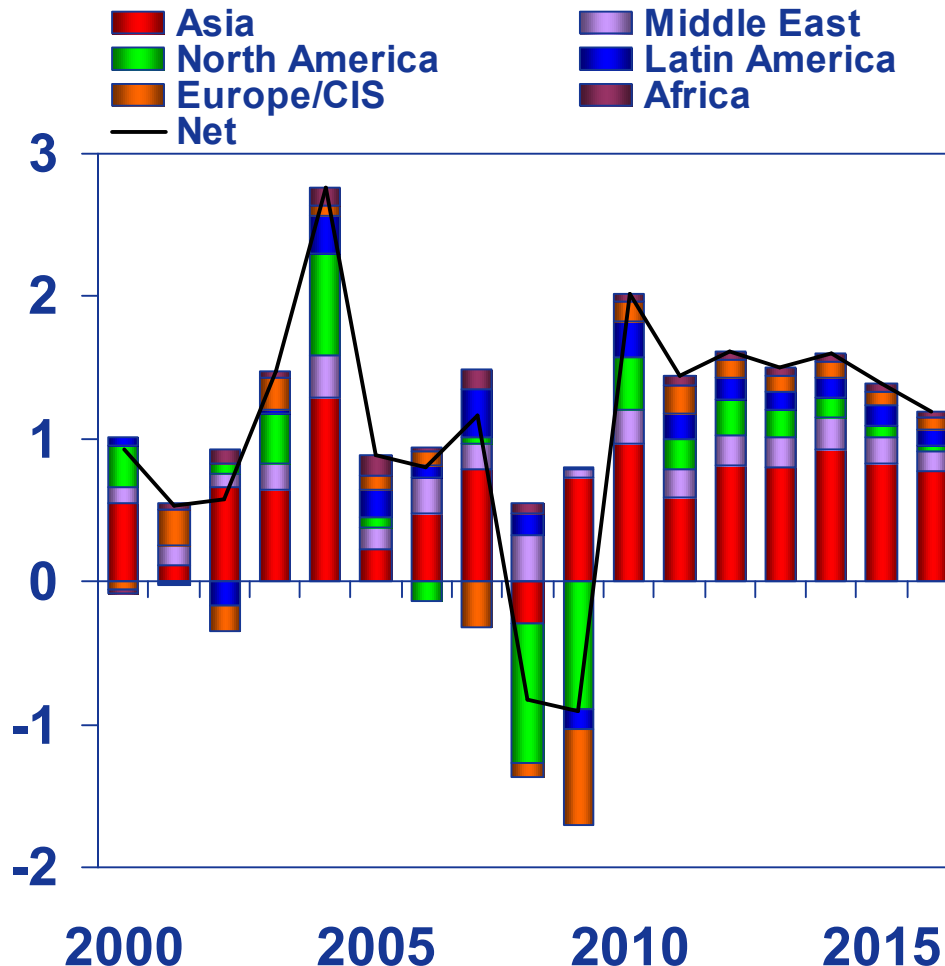


Supply-side Costs Will Maintain Upward Pressure On Crude Price



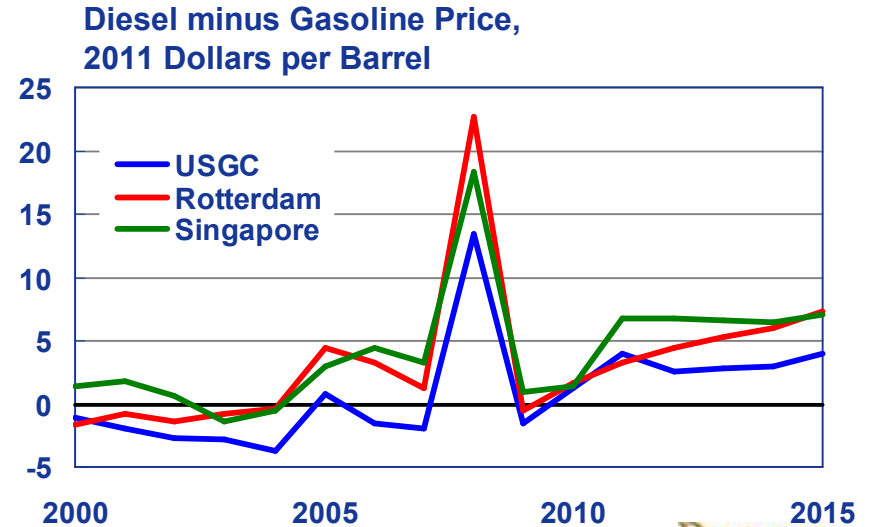
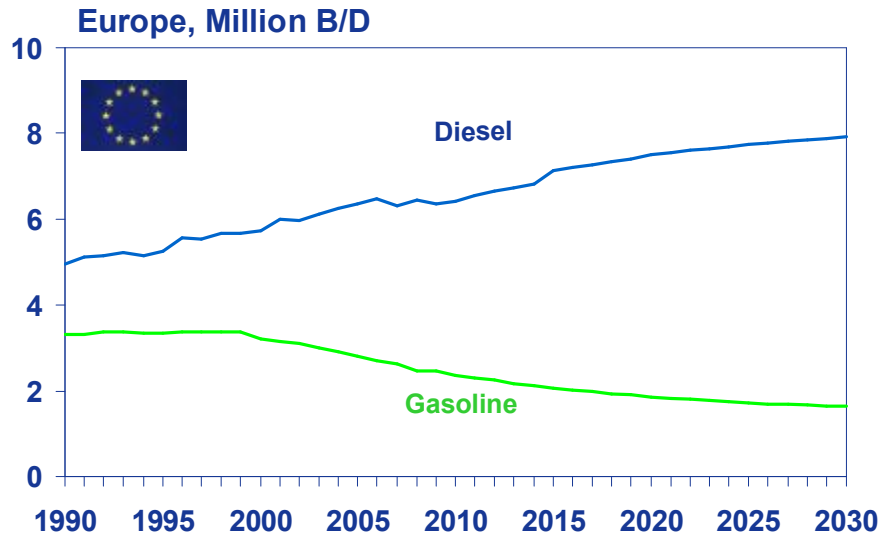
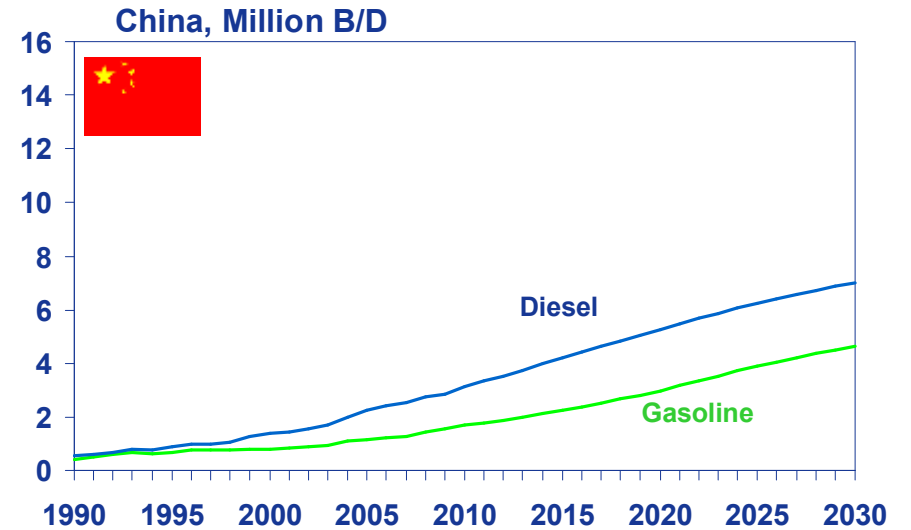
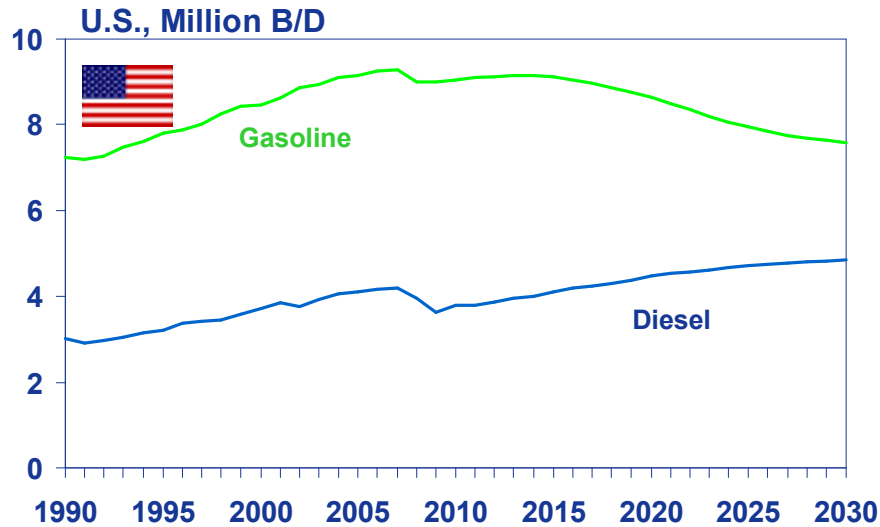
Refined Product Demand Grew Strongly In 2010 Following Recessionary Losses...2011 Is Weaker

Year-to-Year Change, Million B/D



- Ø Recessionary declines hit US particularly hard with much of loss in on-road diesel
- Ø Most emerging markets slowed too
- Ø Reasonable NAm “snap-back” in 2010. Developed economies likely to recover portion of lost demand over next few years
- Ø Emerging markets are key to growth

Significant New Supplies Of Diesel Will Be Required (Prices Support Diesel Over Gasoline)



Based on lower grade gasoline and diesel in each market

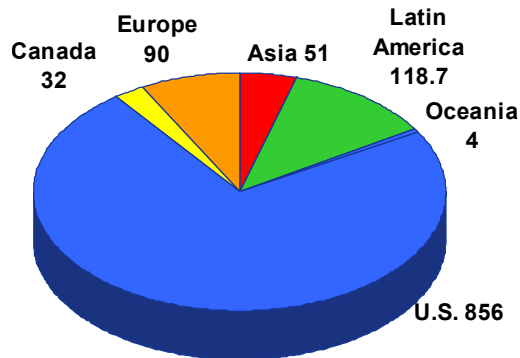
Biofuels Will Continue To Gradually Push Into Refined Products...Without 2nd Generation Breakthroughs

Ethanol Supplied in Gasoline, MB/D

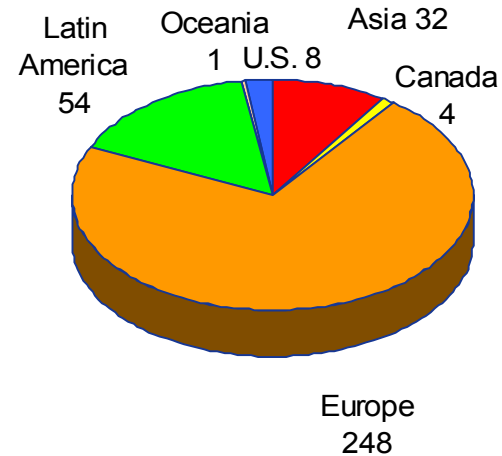
Biodiesel in Diesel, MB/D



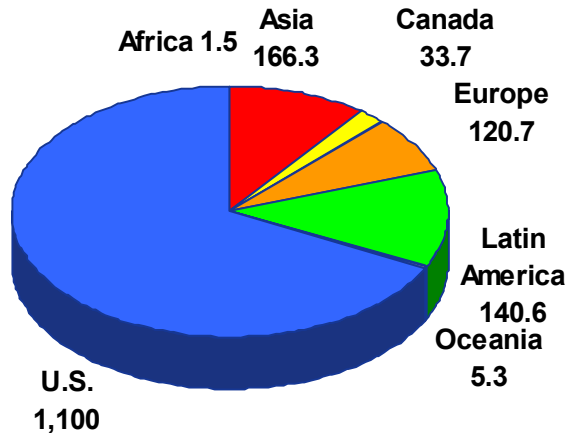
2010 World Total: 1,150 MB/D



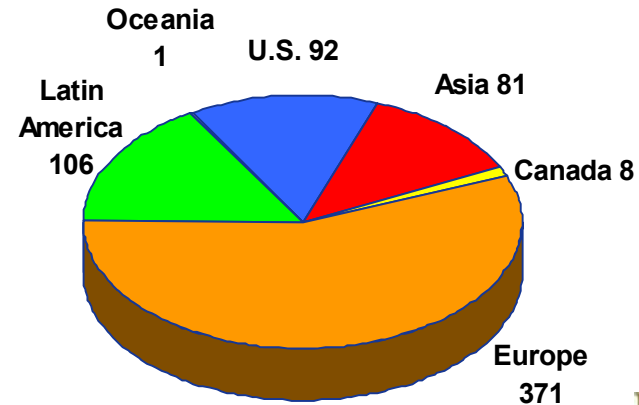
2010 World Total: 350 MB/D



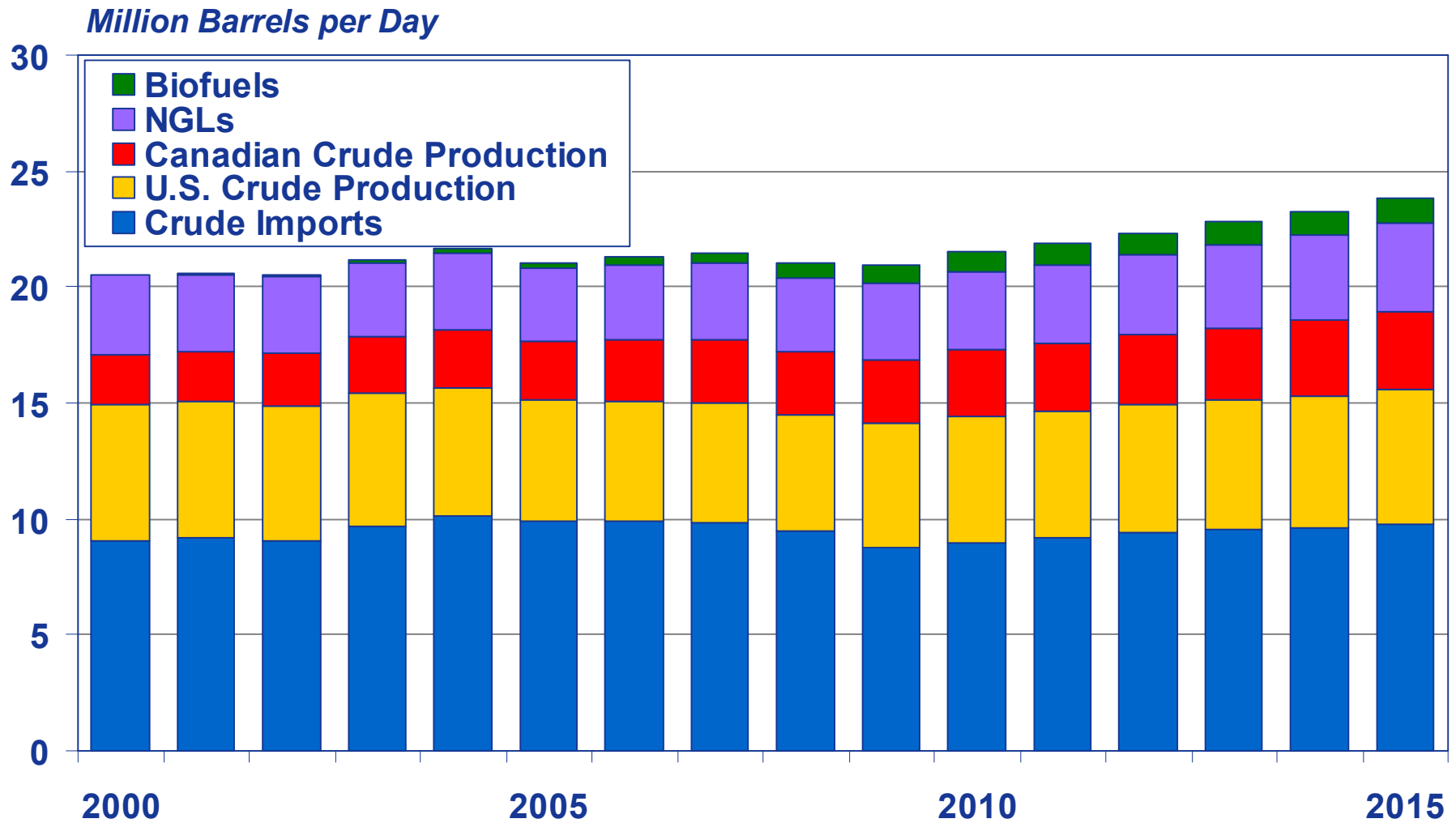
2030 World Total: 1,570 MB/D



2030 World Total: 670 MB/D



North America Biofuels Growth (Expected To Approach 1.0 MM B/D by 2015)



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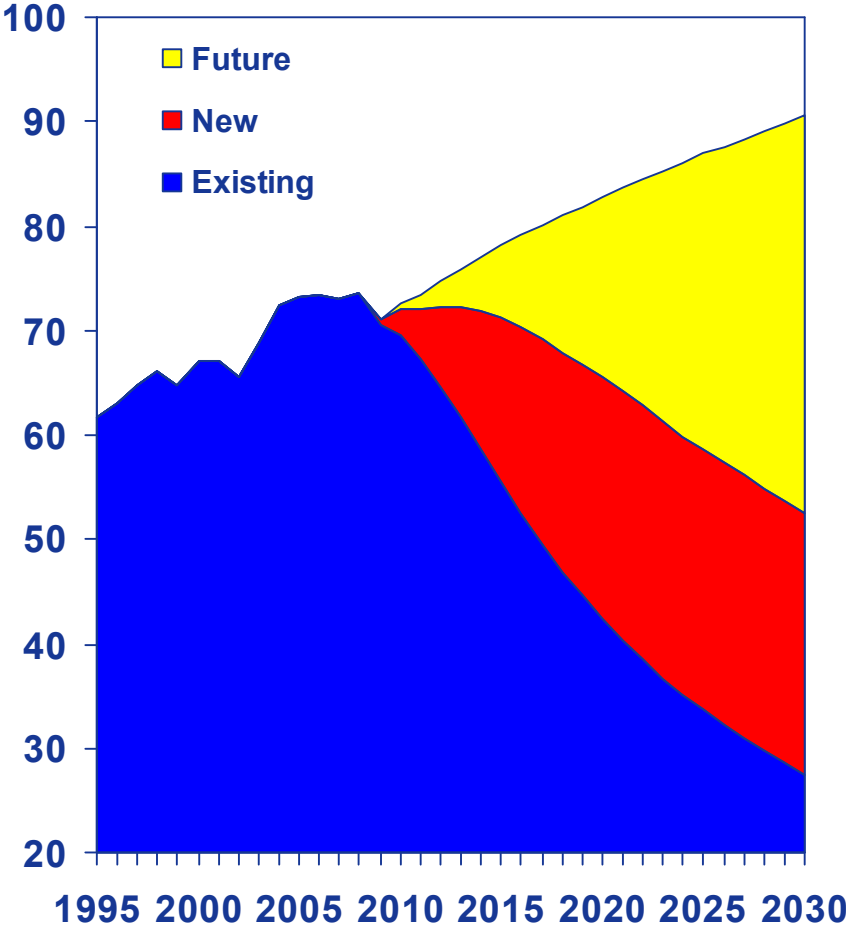


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PGI: A Deeper Dive Into Crude Supply And Availability

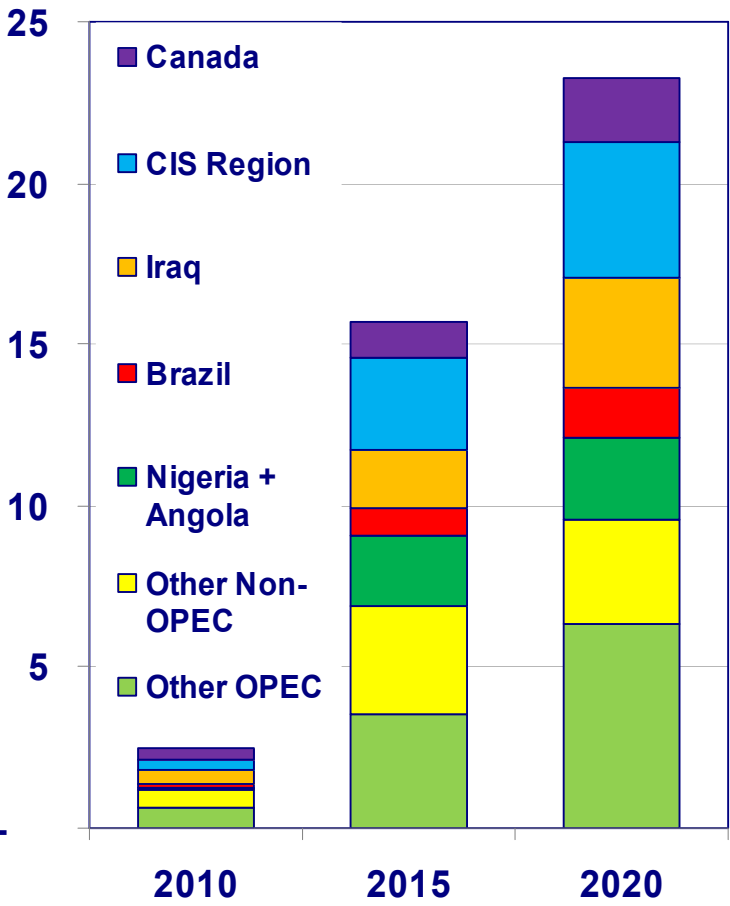
Global Production by Development Type

Million B/D



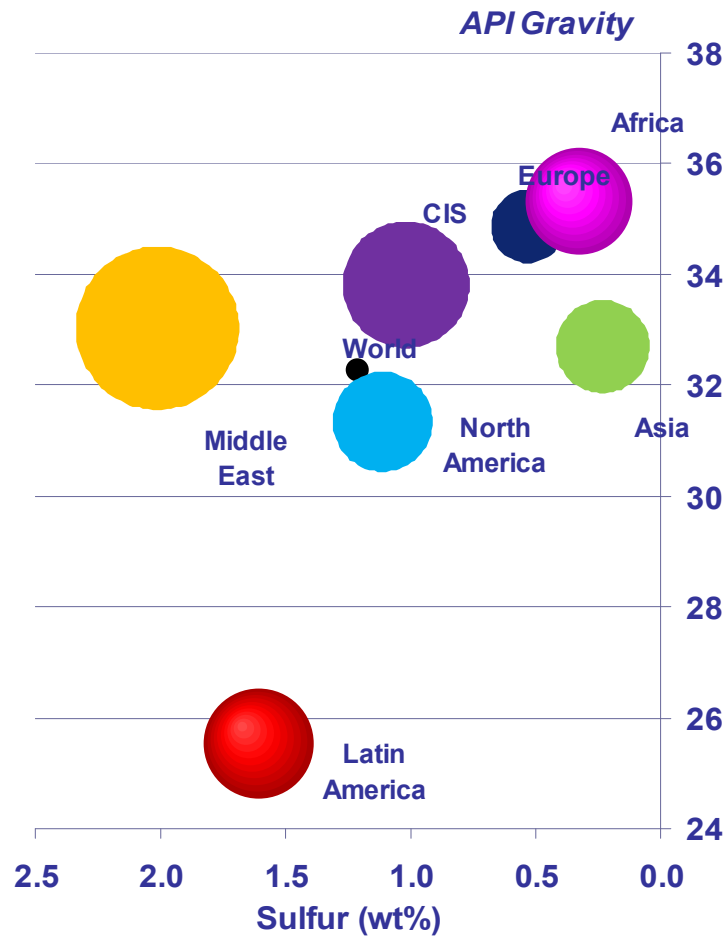
Global Oil Production: New Developments

Million B/D

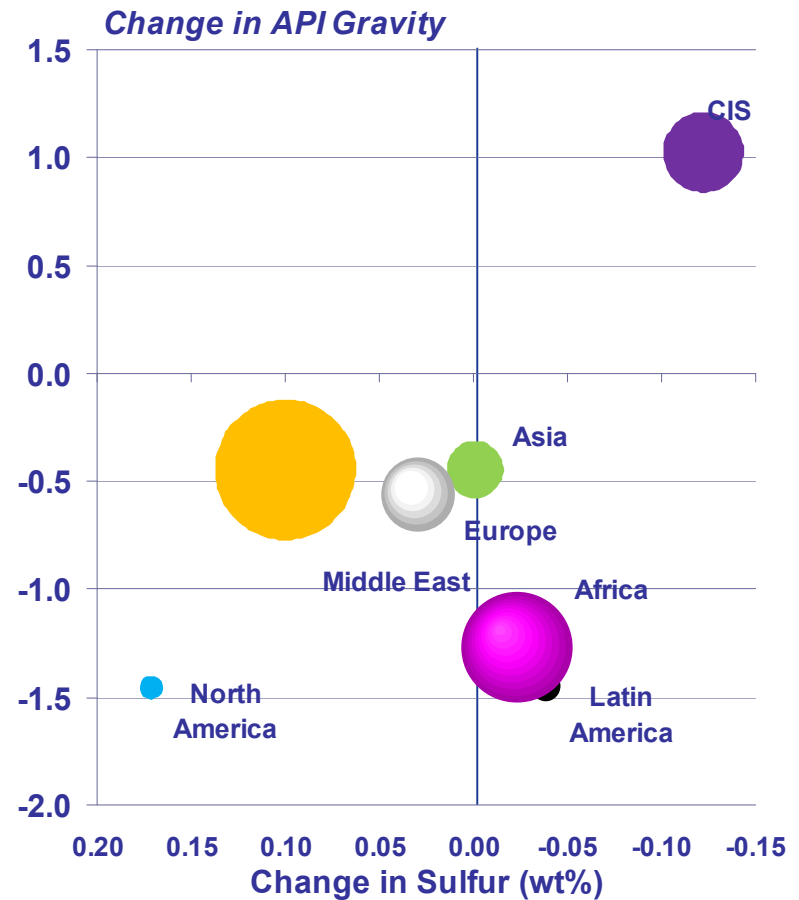


Evolution Of Crude Qualities (Most Regions Getting Marginally Lower In Bulk Qualities)

2009 Crude Quality by Region



Change in Quality by 2020 by Region



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Market Environment for Crude Production

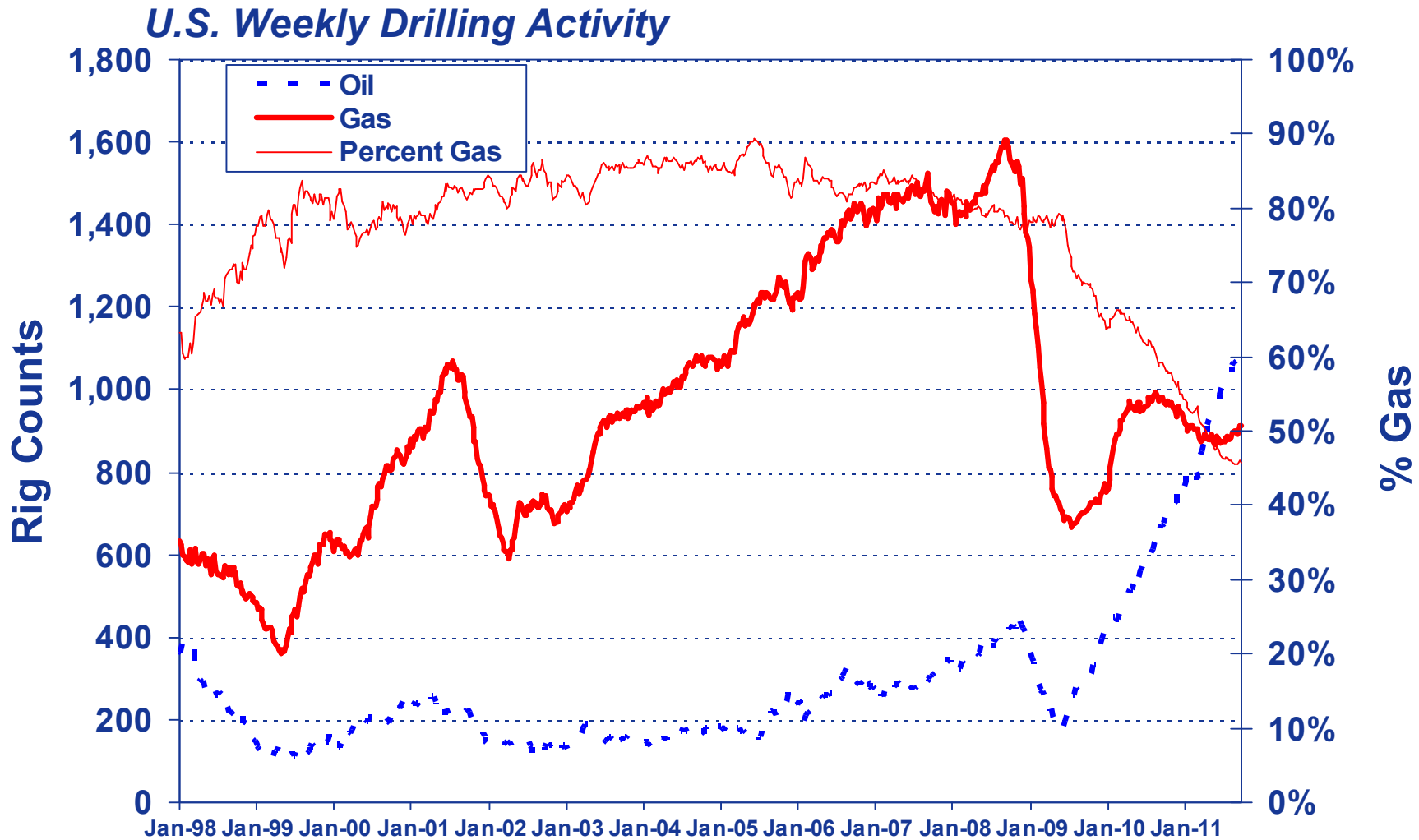
- Ø **PGI anticipates a generally favorable market environment for growing output**
 - § **Dated Brent long-term price expected in \$100/B range**
 - § **High price track provides necessary incentive for continued strong upstream activity**

- Ø **Strong activity not only in well publicized shale plays, but also conventional production and oil sands**
 - § **Recent output increases seen in mature U.S. basins including, Permian Basin, Uinta Basin, and Powder River**
 - § **Improving economics increase continued probability of future oil sands development**
 - § **Anticipate return to U.S. Gulf of Mexico activity since lifting of federal deepwater moratorium**

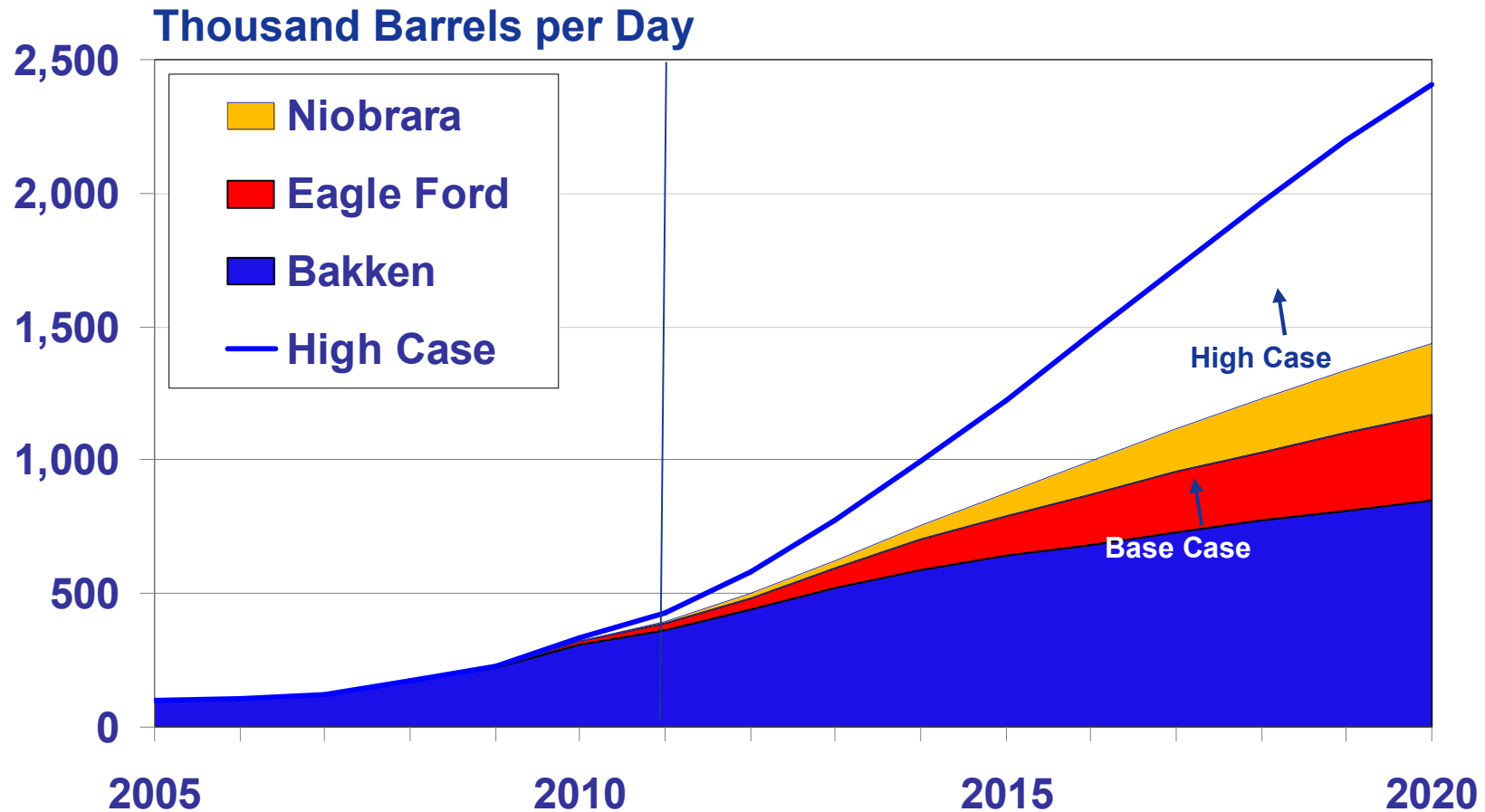
Rig Activity and Well Completions Outlook

- Ø Rig activity in oil shale plays have increased rapidly from 2008/09 levels but are expected to increase at a more moderate rate in the future
- Ø Completions continue to be a limiting factor for the shale plays
 - § Well inventories continue to rise
 - § Oil service companies are lacking both qualified personnel as well as equipment (i.e. HP pumps) and supplies (i.e. sand, water, proppant)
- Ø Cost of completions is also increasing – due to supply/demand pressures
 - § Depending on fracturing stages and proppant utilized completions can exceed drilling costs
- Ø Our outlook assumes the completion backlog continues near-term

U.S. Oil Directed Drilling Has Skyrocketed (Approaching 1100 Rigs – Producers Shift From MCF to BBL)



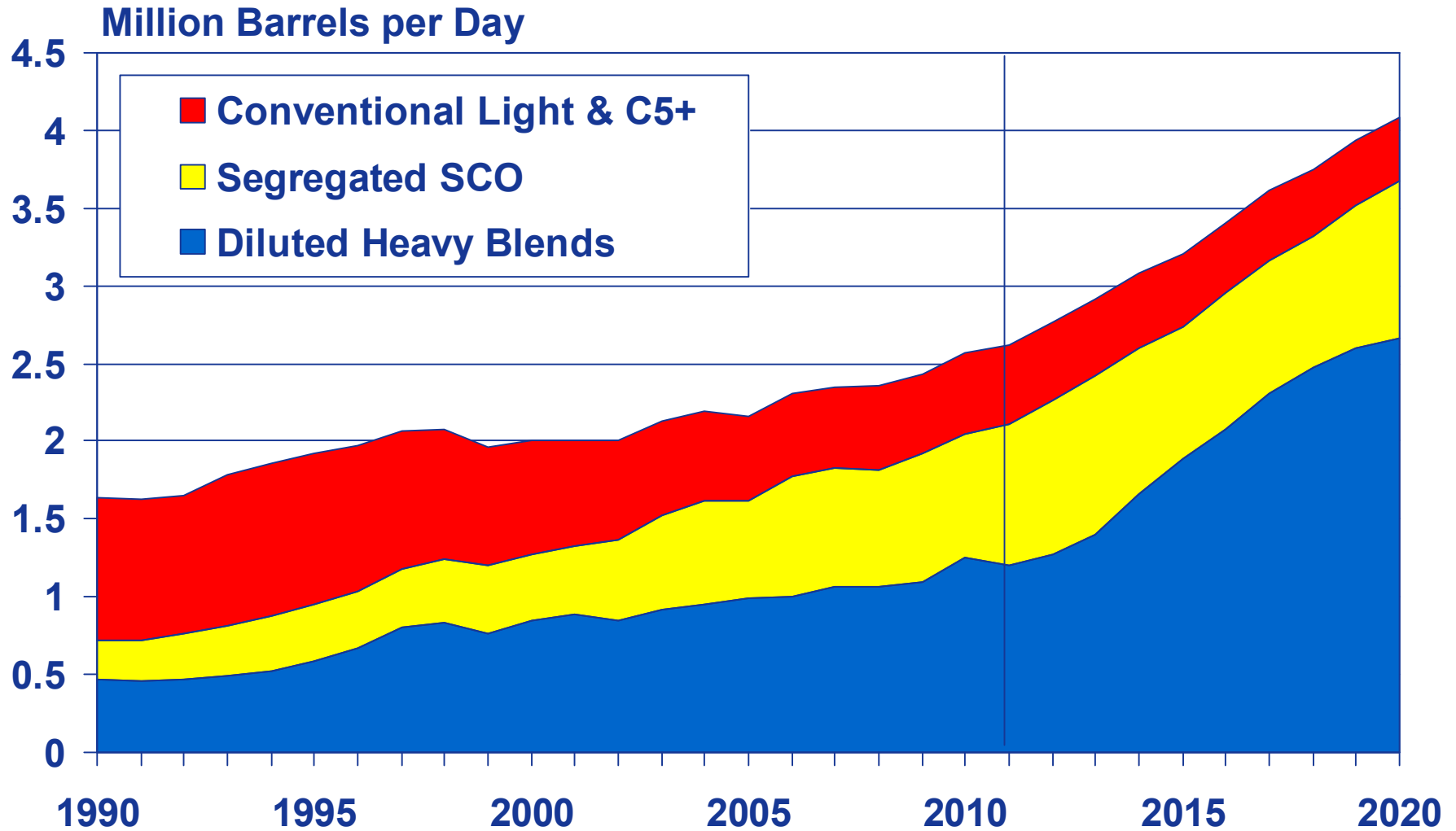
U.S. Shale Oil Output Forecast



Note: Chart does not include segregated condensate production from Eagle Ford.

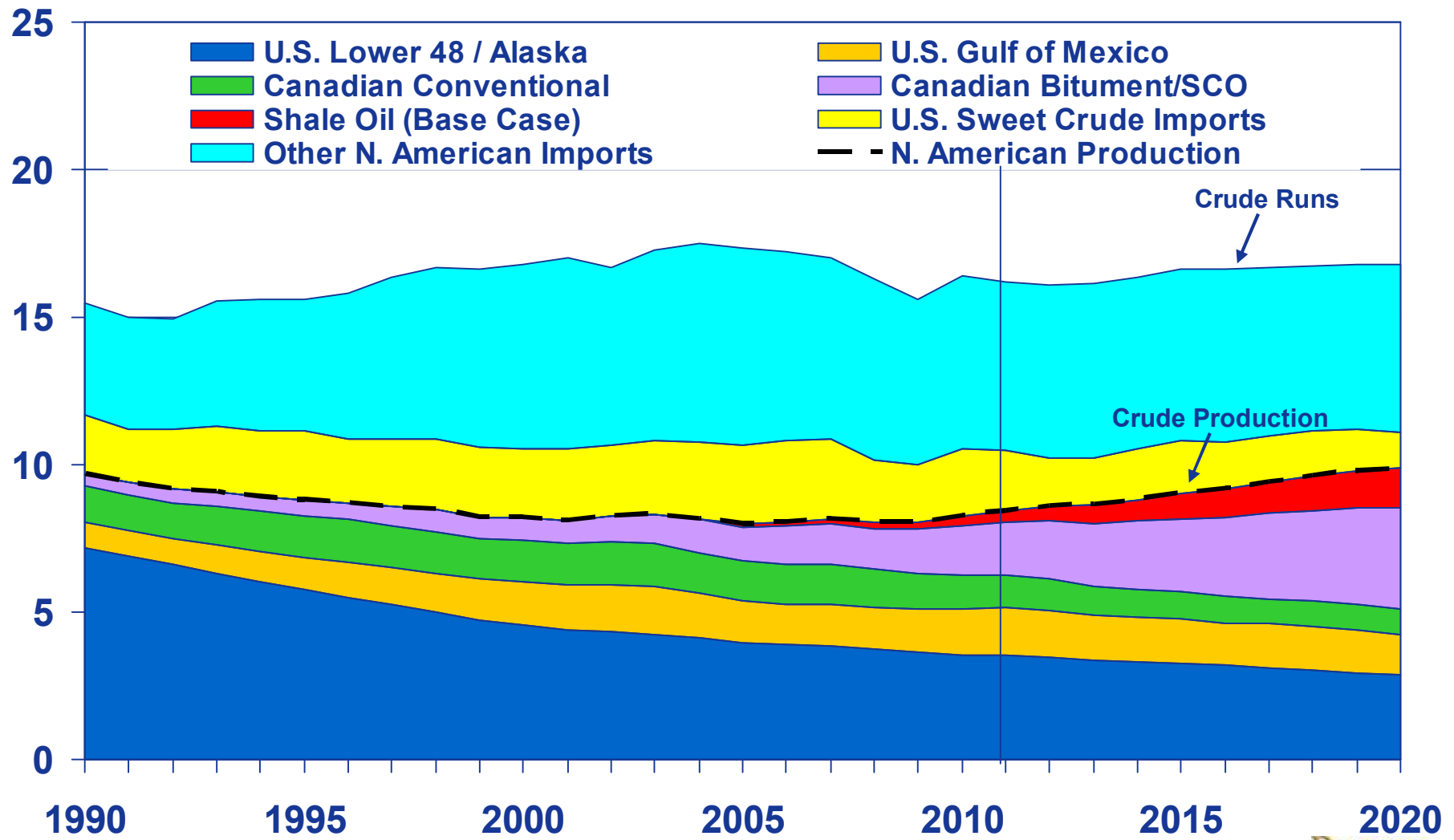
Shale oil output forecast to reach 900,000 B/D by 2015 and surpass 1.4 million B/D by 2020

Western Canadian Crude Oil Supply



North American Crude Oil Balance (Squeezing The Mid-Continent)

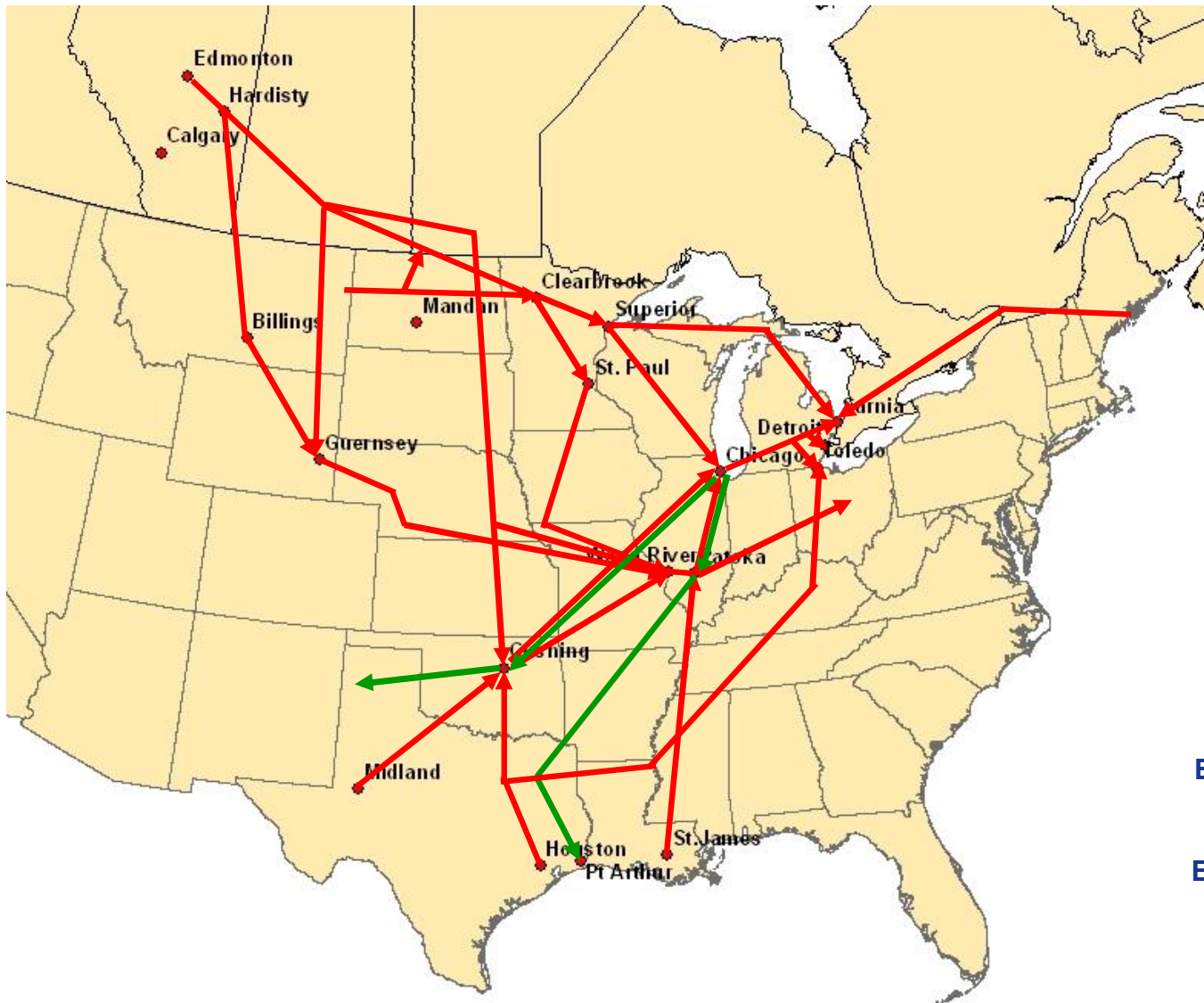
North American Crude Oil Supplies, Million Barrels per Day



Current U.S. / Canadian Logistics Overview

- Ø **Midwest refining projects and increases in U.S. and Canadian production straining current logistics system**
- Ø **Current crude oil pipeline capacity designed to transport imported crude oil from the U.S. Gulf Coast and Canada to inland markets**
- Ø **Does not provide the adequate take-away capacity for growing supplies of U.S. Mid-Continent crude oil**

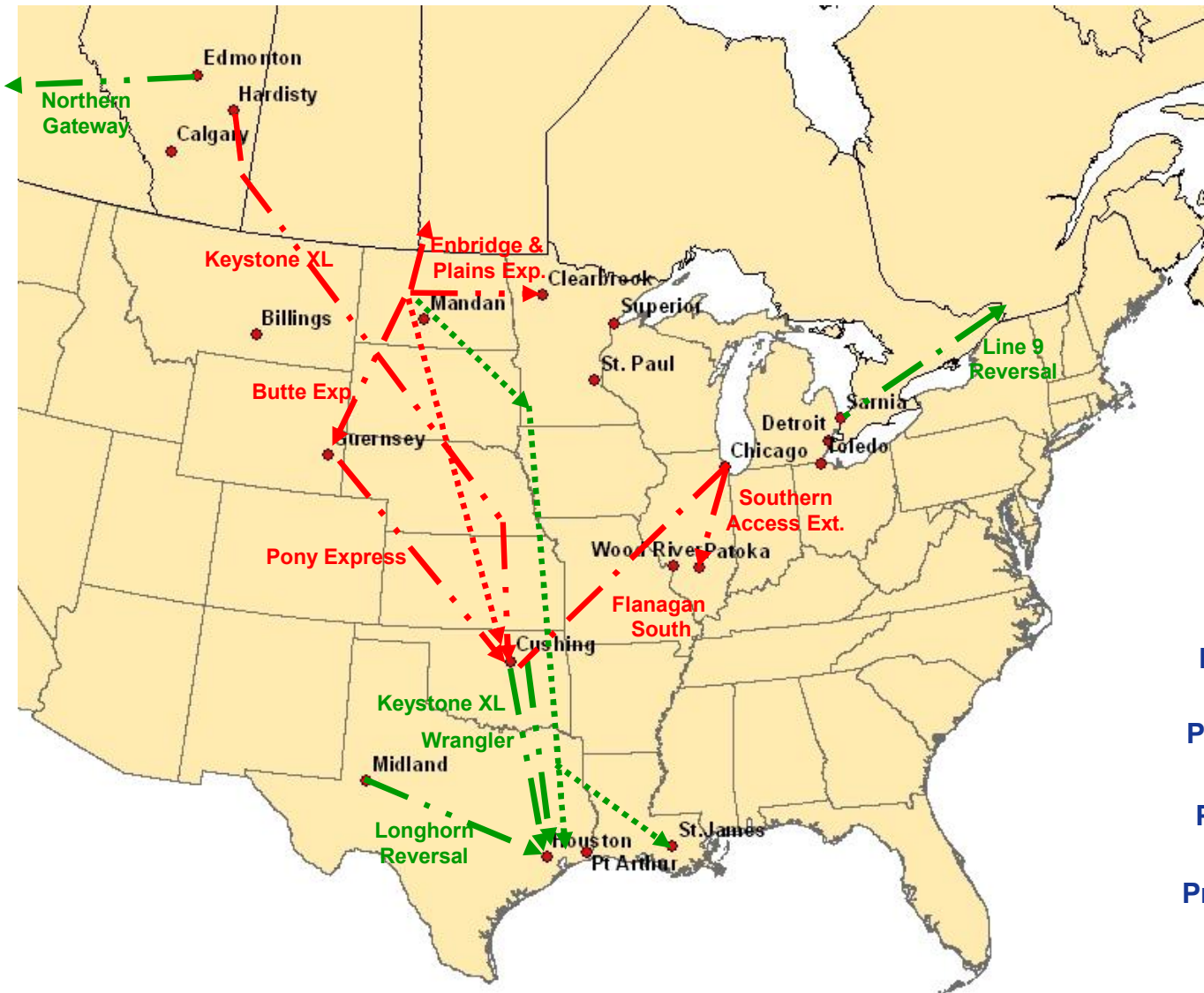
Midwest Crude Oil Pipelines







Existing Midwest Inbound pipeline capacity ~ 5.3 million B/D compared to 200,000 B/D of existing outbound capacity

Existing Inbound Pipelines
Existing Outbound Pipelines

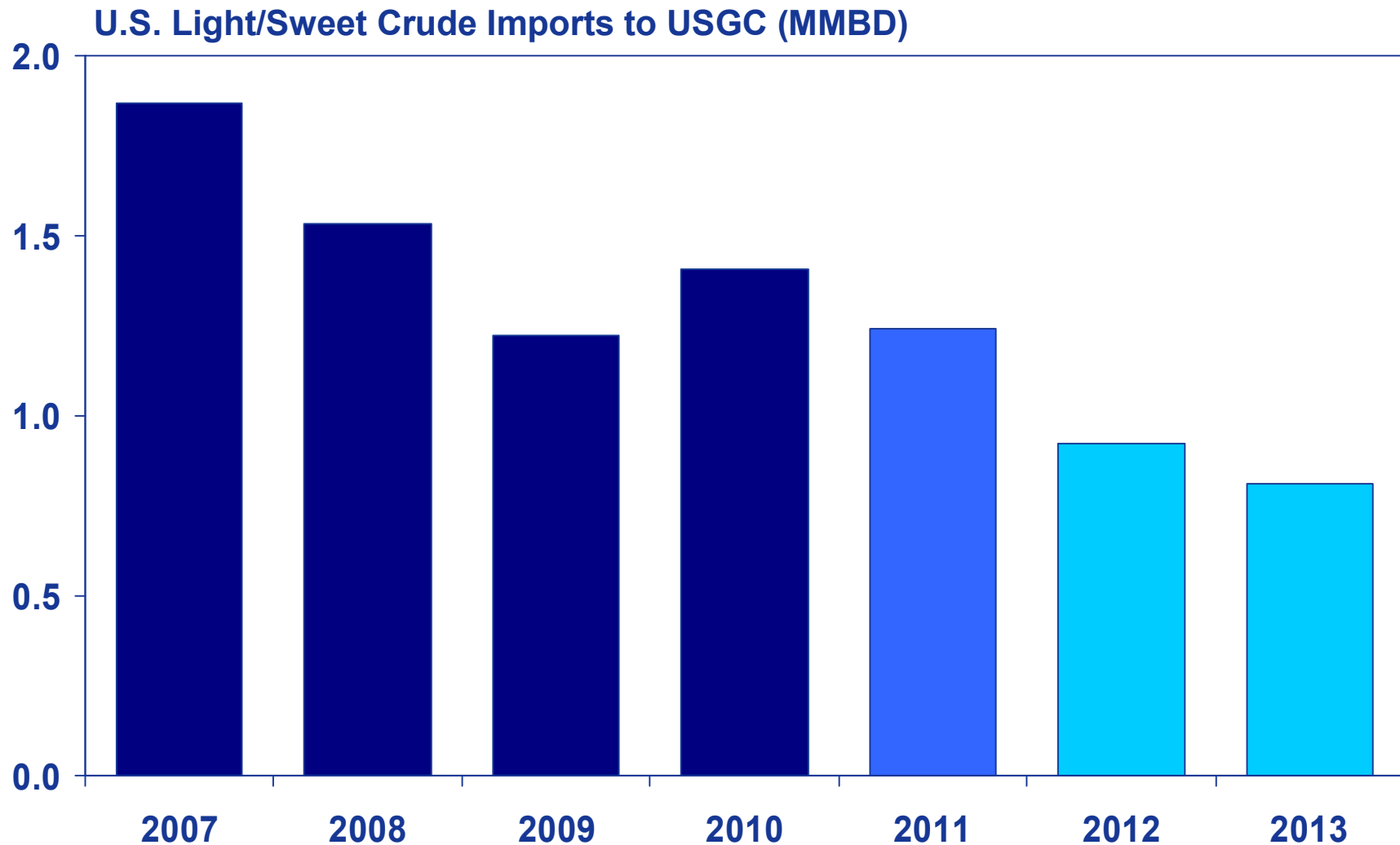
Proposed Pipeline / Logistics Projects



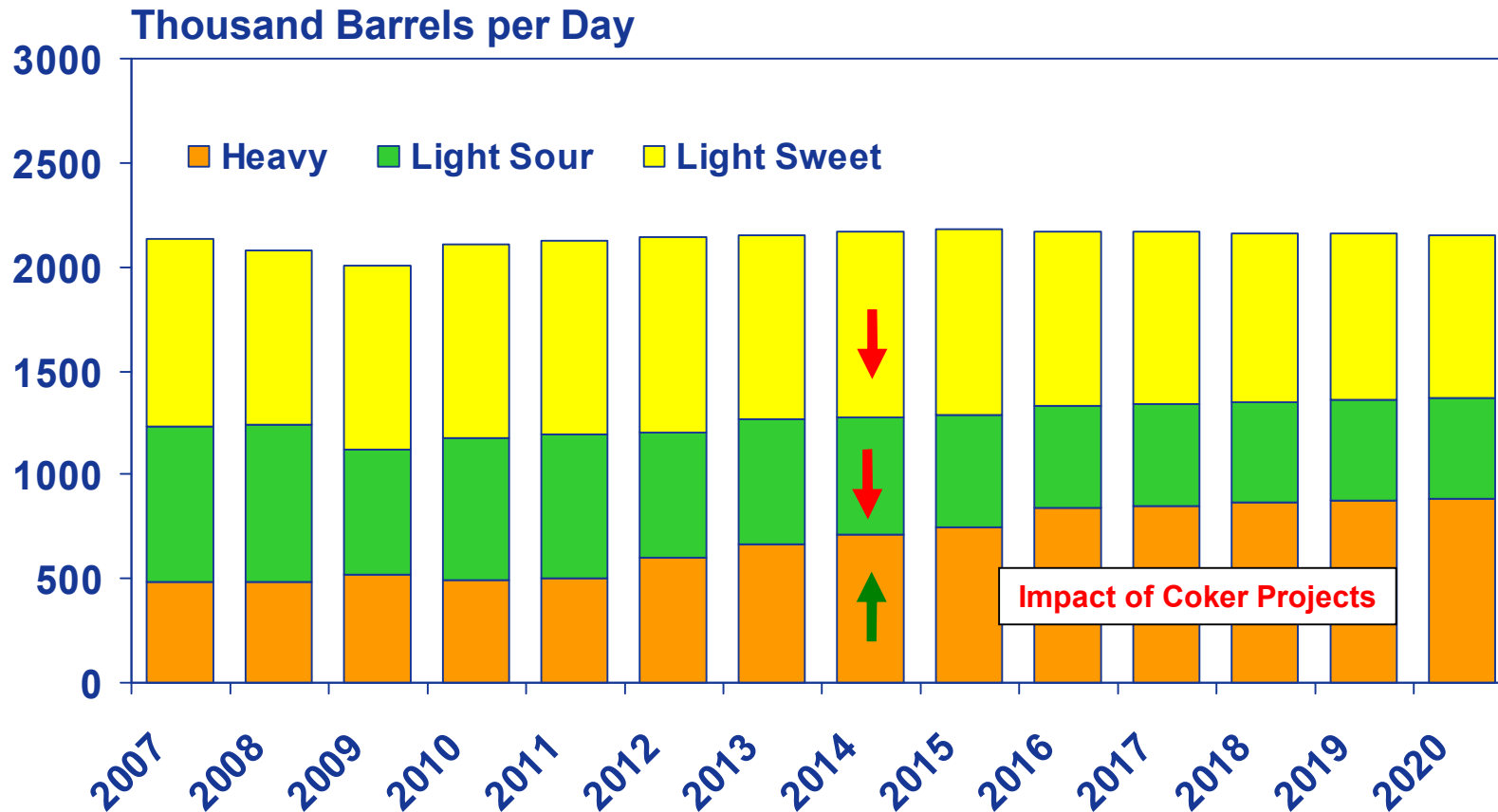
Over 1 million B/D of Cushing outbound pipeline capacity potential as projects

-  Proposed Inbound Pipelines
-  Proposed Outbound Pipelines
-  Proposed Inbound Rail Links
-  Proposed Outbound Rail Links

USMW oversupply, including Eagle Ford will require reduction of light/sweet crude imports

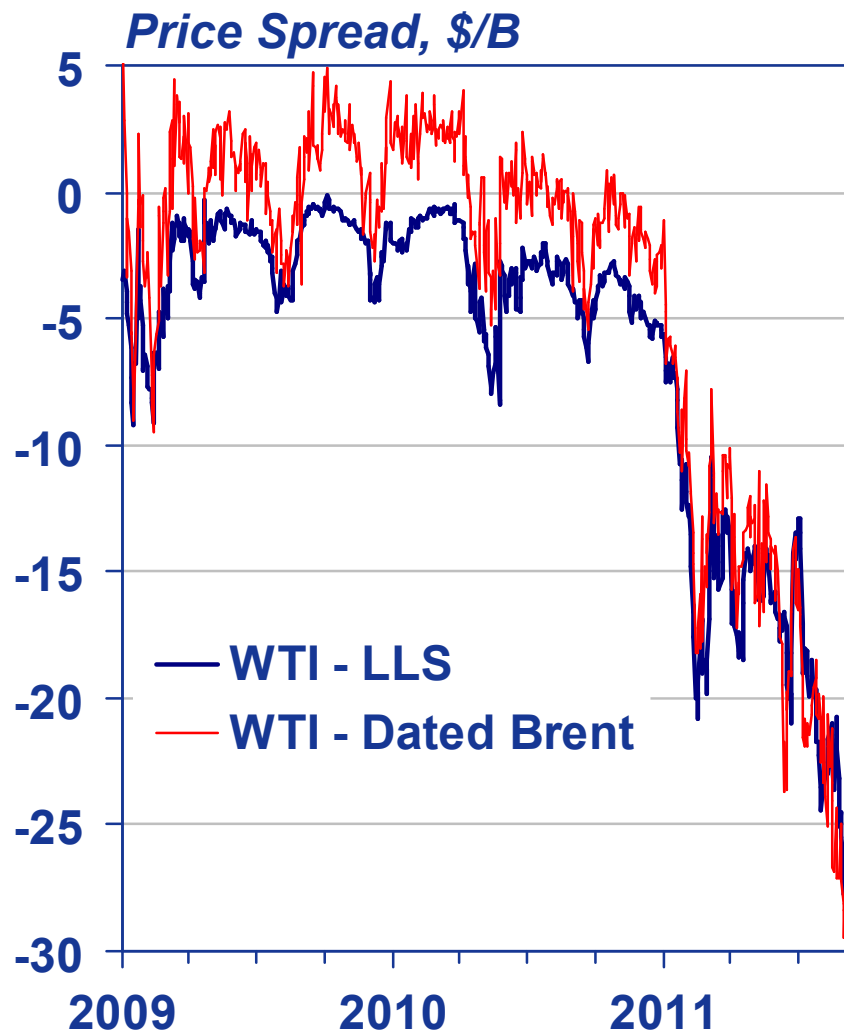


Midwest Refinery Runs Outlook



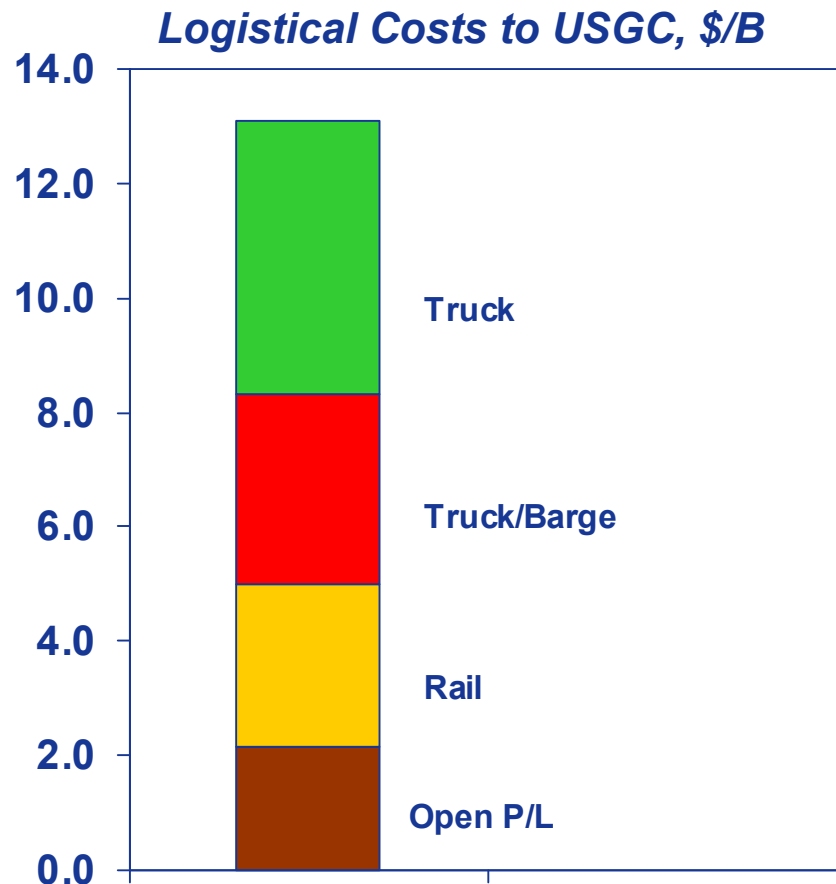
Canadian heavy crude runs in the U.S. Midwest expected to increase ~ 250,000 B/D by 2015 as a result of projected investments.

Oversupplied Market and Misaligned Logistics Creating Massive WTI Price Discount To USGC & International Crude



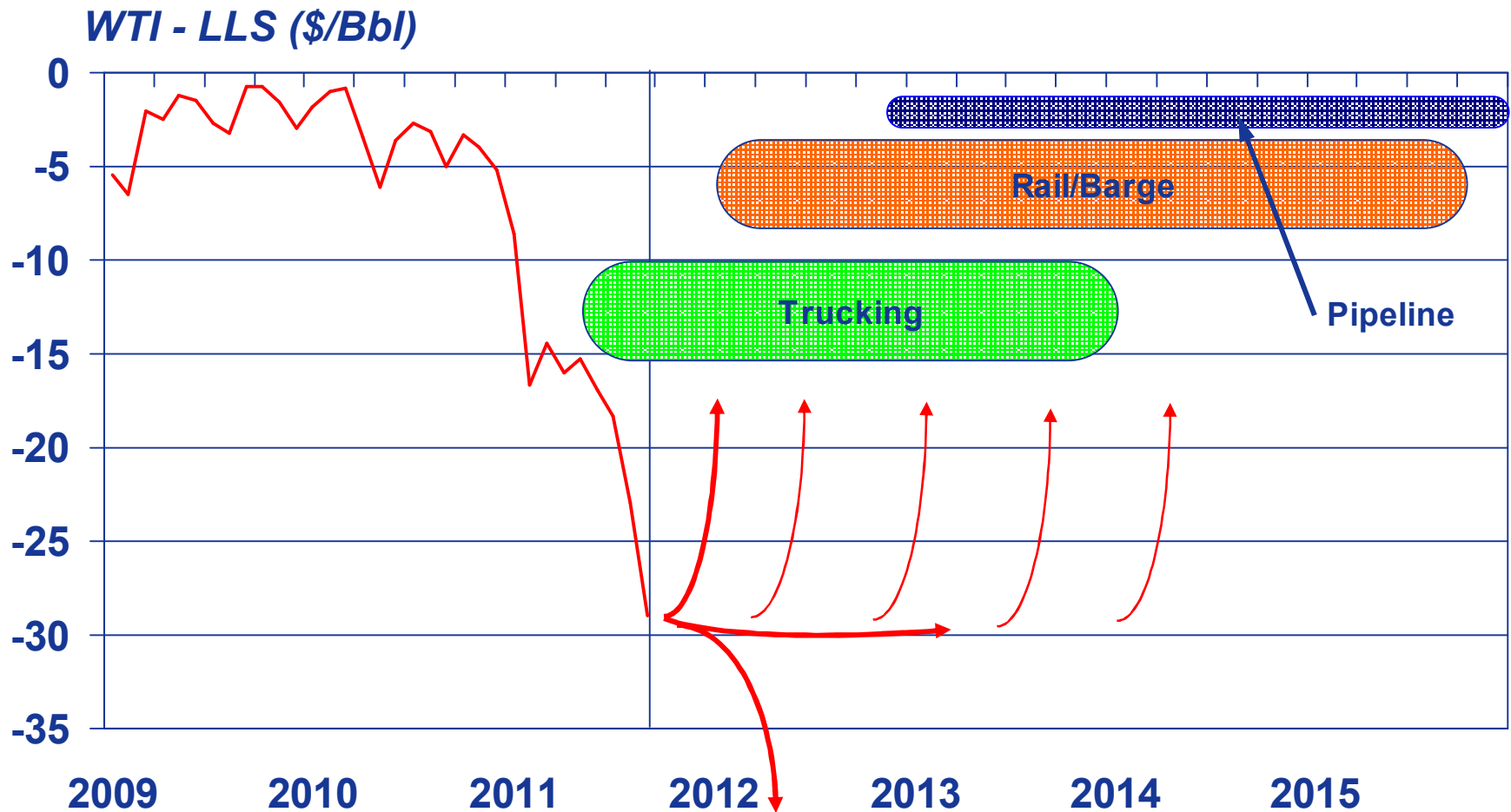
- ∅ Current discount is a mix of:
 - § Real physical constraints and
 - § Market psychology
- ∅ Pipeline infrastructure has evolved to be Inbound
- ∅ Outbound pipes are limited and full
- ∅ New rail facilities are being added but supply is growing rapidly
- ∅ Once a pipeline is built to relieve Cushing, WTI discount will remain near tariff costs

WTI Price Discounts (Exceeded the Highest Of Logistical Costs)



- Ø Price discount above “typical” trucking cost
 - § Issue is tank truck supply and competition from frac demand for trucks
- Ø Lack of rail loading facilities at Cushing and limited unloading capacity in USGC
 - § New rail facilities are being added
- Ø Major pipeline ultimately expected to relieve Cushing bottleneck and dissipate the WTI discount
- Ø WTI price will ultimately move to a Houston netback value

Where Does WTI Price Go From Here? ...And When?



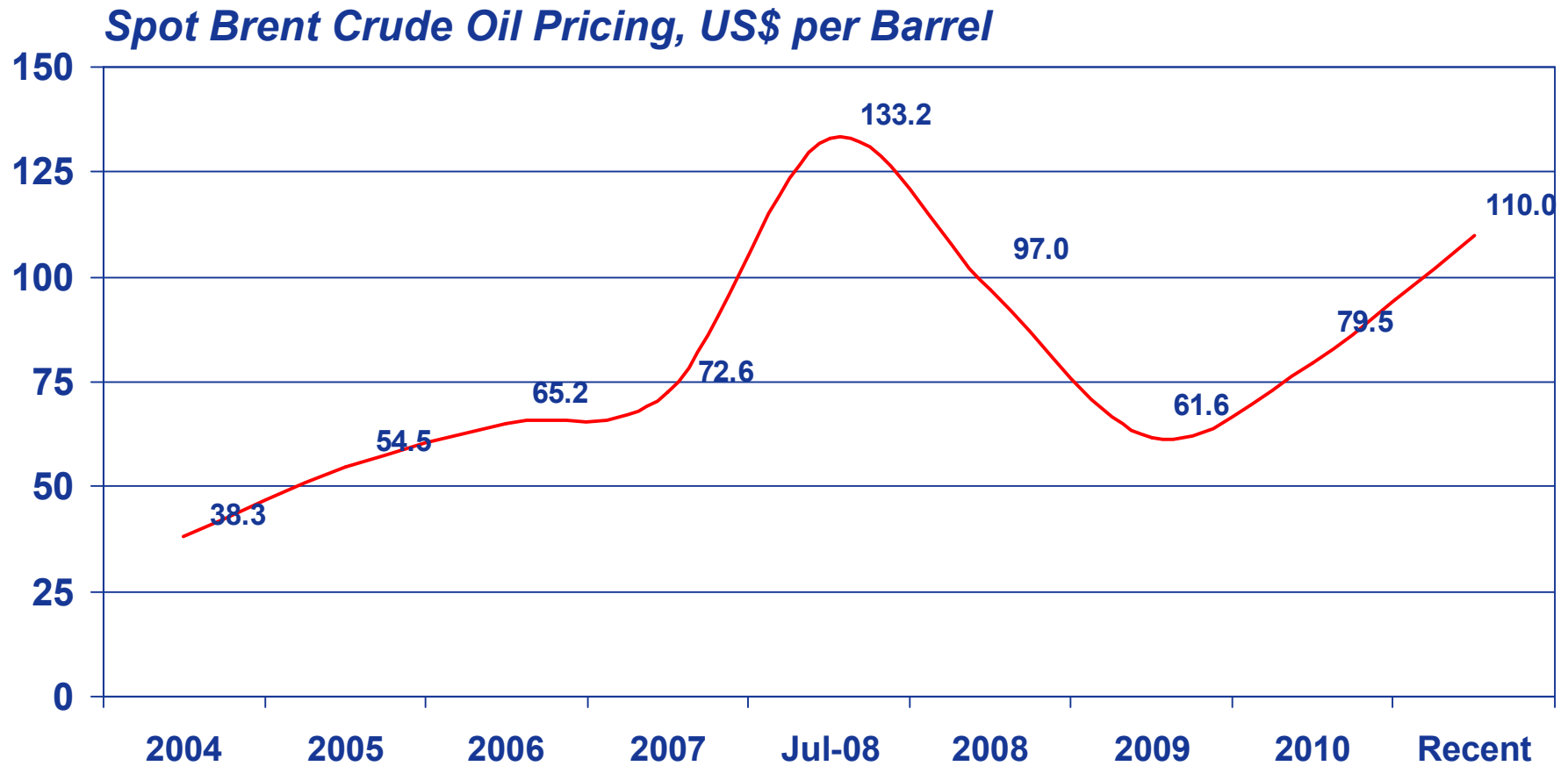
Major correction will occur quickly, but not necessarily soon

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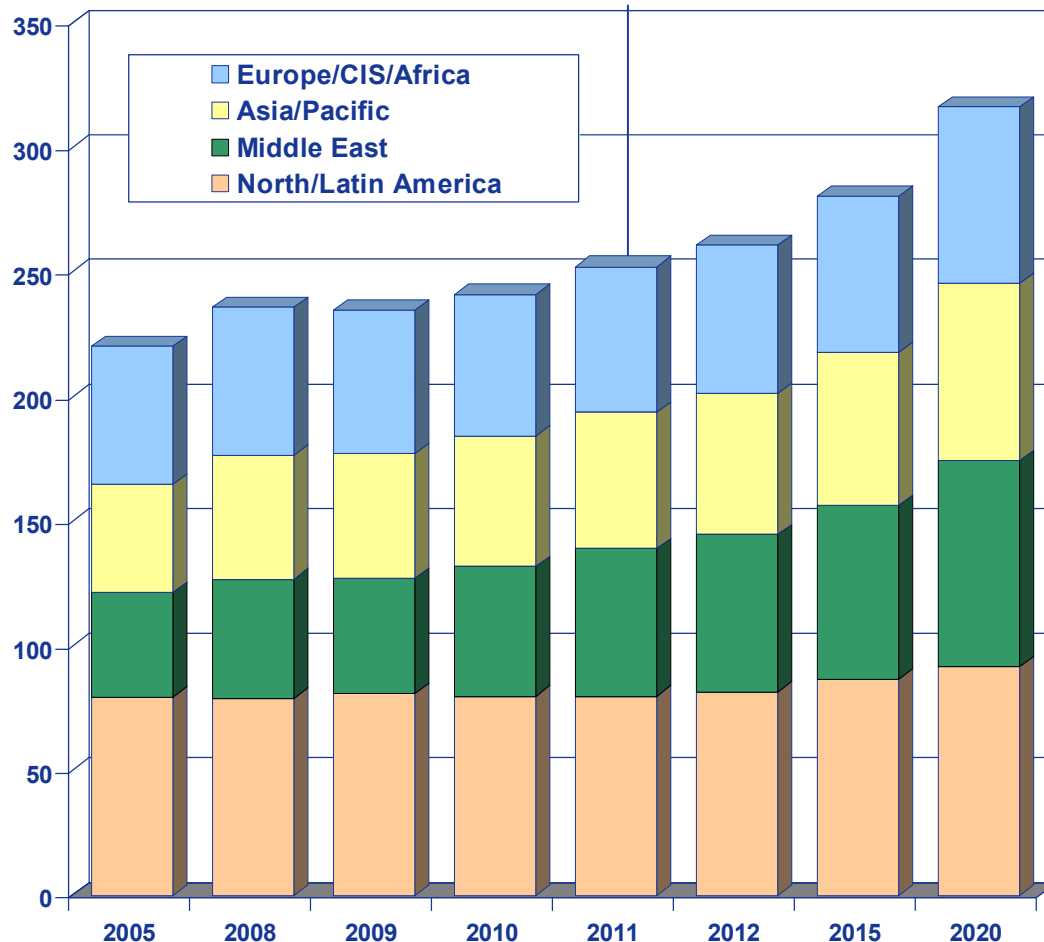
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Crude Oil Prices Have Increased Significantly Since the 2006/7 Timeframe and Impacting LPG Markets



Global LPG Supply is Expected to Undergo a Significant Expansion Over the Next Several Years...And Keep Rising

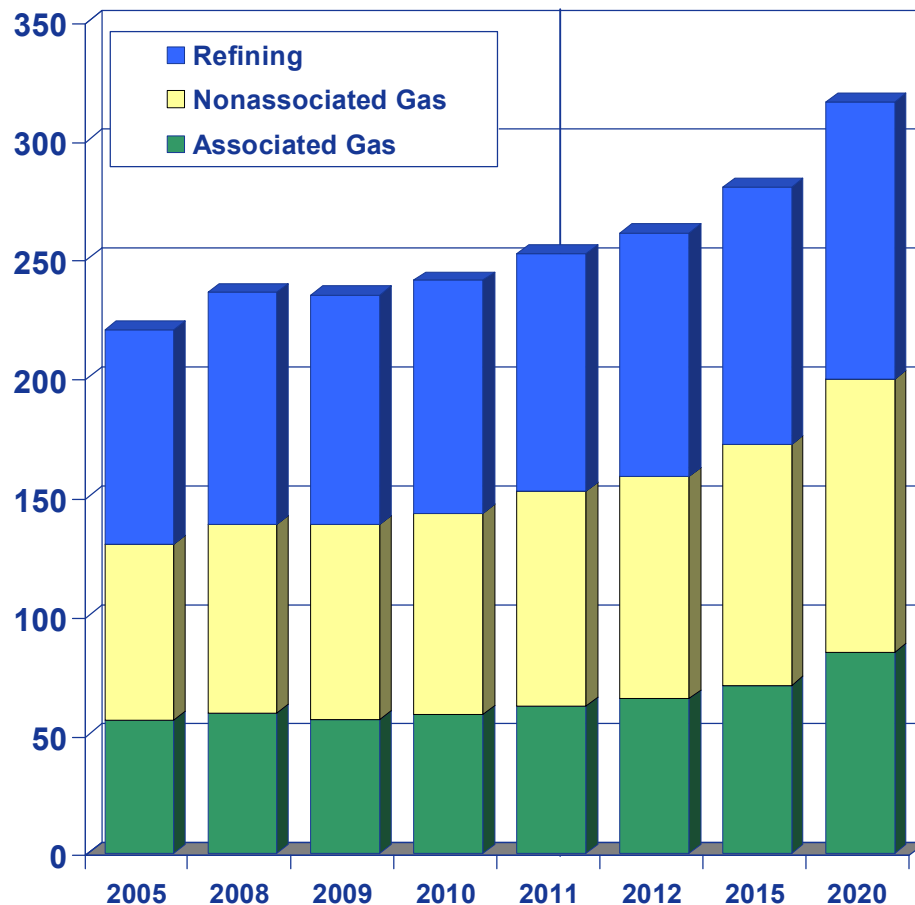
World LPG Supply by Region, Million Tonnes/Yr



- Ø LPG production is expected to rise in most regions of the world. Global production (2011) is projected to be around 250 MM tonnes.
- Ø Global LPG production declined slightly in 2009 as a result of the global recession—but supply has increased since.
- Ø Significant supply growth is expected to occur between 2011 and 2015—an expansion of around 30 million tonnes/yr is expected.
- Ø Supply growth will be very strong in the Middle East in the future.

Most of the Growth in Global LPG Production Will Continue to Be Sourced From Natural Gas

LPG Supply, Million Tonnes/Yr



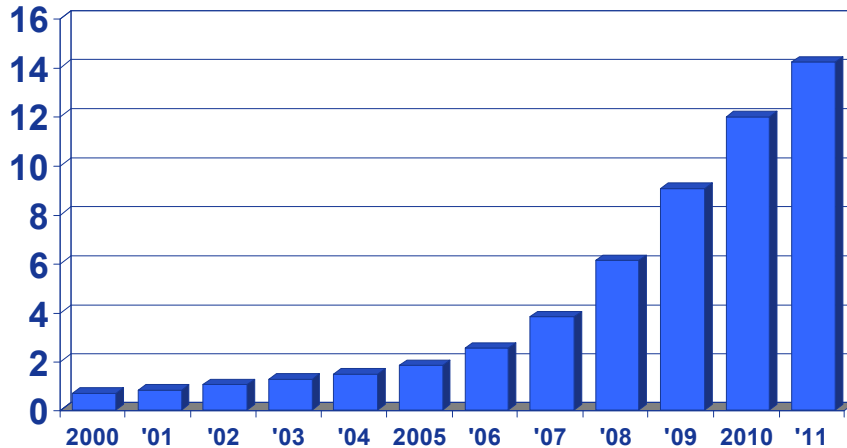
- ∅ **Current LPG supply profile:**
 - § **Associated Gas** **24%**
 - § **Nonassociated Gas** **36%**
 - § **Refining** **40%**

- ∅ **Natural gas demand is growing faster than petroleum demand.**

- ∅ **As a result, LPG production from gas processing is expanding faster than refinery production.**

Shale Gas Development Is Transforming the U.S. Natural Gas Industry—It Could Have Significant Global Implications

U.S. Shale Gas Production, Bcf/day



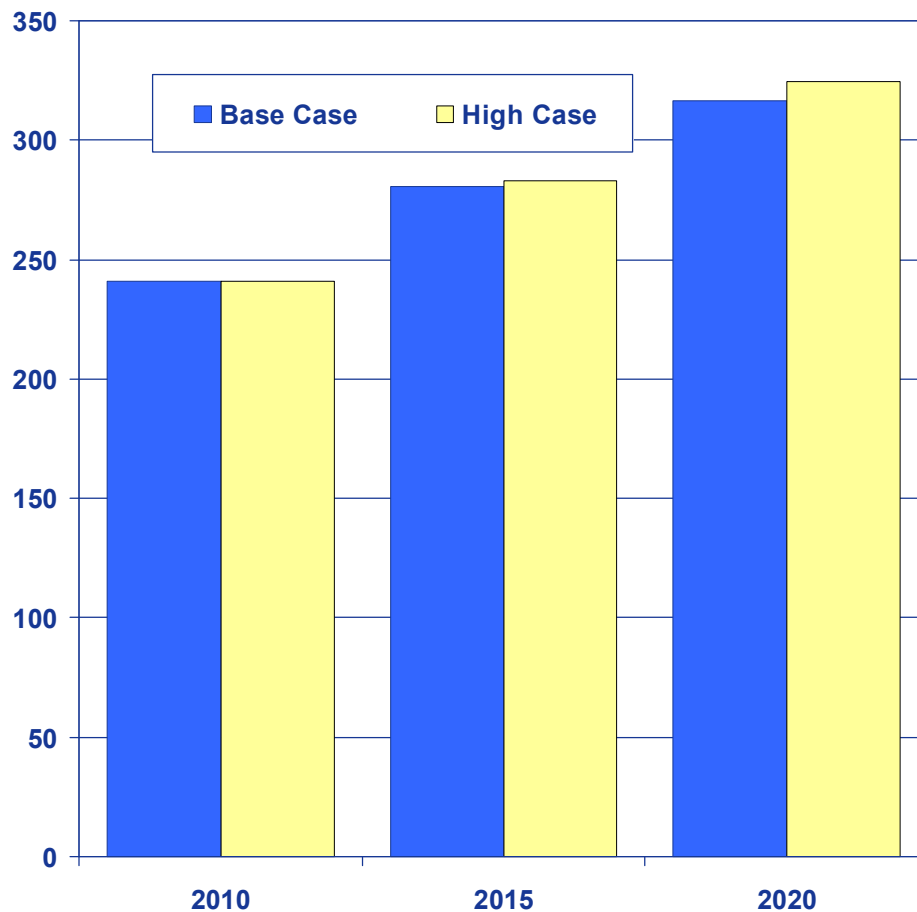
Spot Henry Hub Natural Gas Price, \$/MM Btu



- Ø U.S. shale gas production is rising very quickly:
 - § Increased from 4 to 14 BCF/D in 4 years - has kept U.S. gas prices low.
- Ø North America has moved from a gas supply-short region to a supply-long region.
- Ø LPG production is starting to increase in the U.S. with the sharp rise in shale gas production.
- Ø Over 15% of total U.S. LPG production from natural gas is already from shale—over 5 million tonnes/yr.
- Ø The long-term potential to expand global gas supply and LPG supply is relatively large.

Global LPG Supplies – Faster Expansion? (If Shale Gas Development Becomes Widespread)

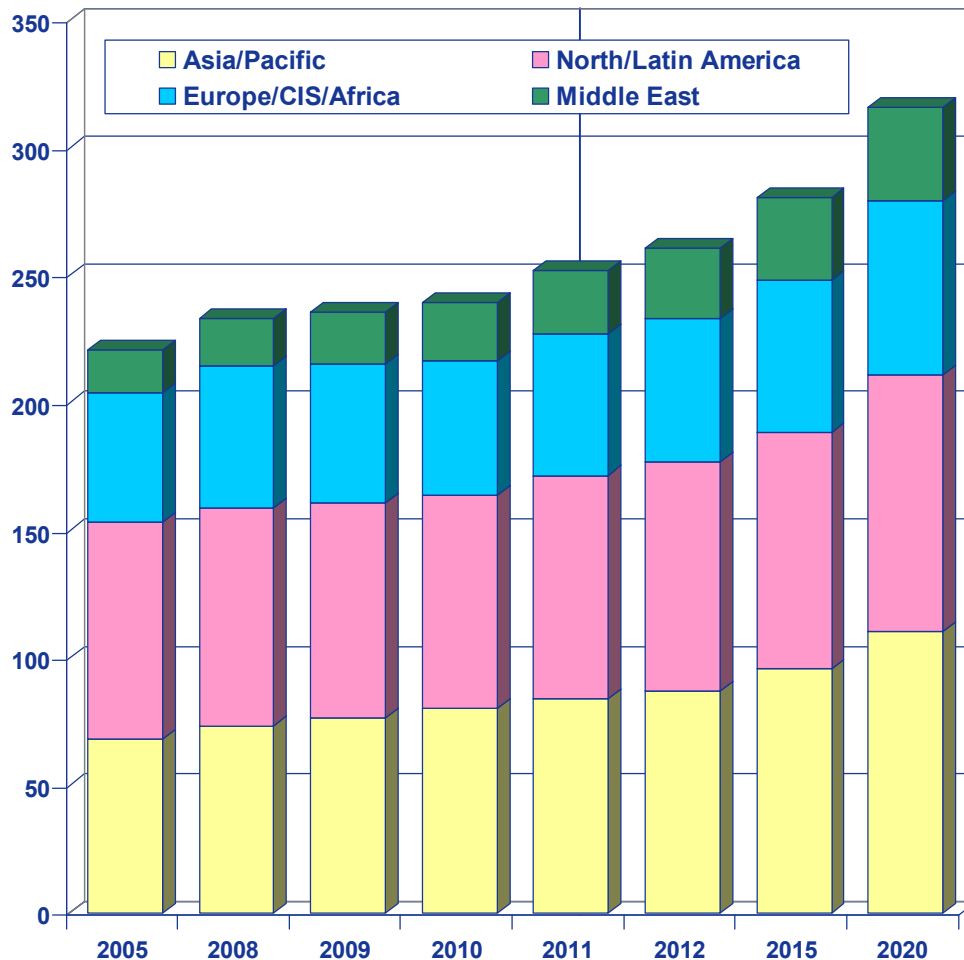
LPG Supply, Million Tonnes/Yr



- Ø Global natural gas markets are expanding reasonably fast already—but might expand even faster if global development of shale gas occurs fairly rapidly.
- Ø This would allow gas to take a larger share of the global industrial and power fuel market in the future.
- Ø As gas production increases, LPG production would also rise.
- Ø Thus, there is considerable upside to the base case outlook for LPG supplies—depending on how global gas developments proceed.

The Strongest Growth Markets for LPG (Asia And The Middle East)

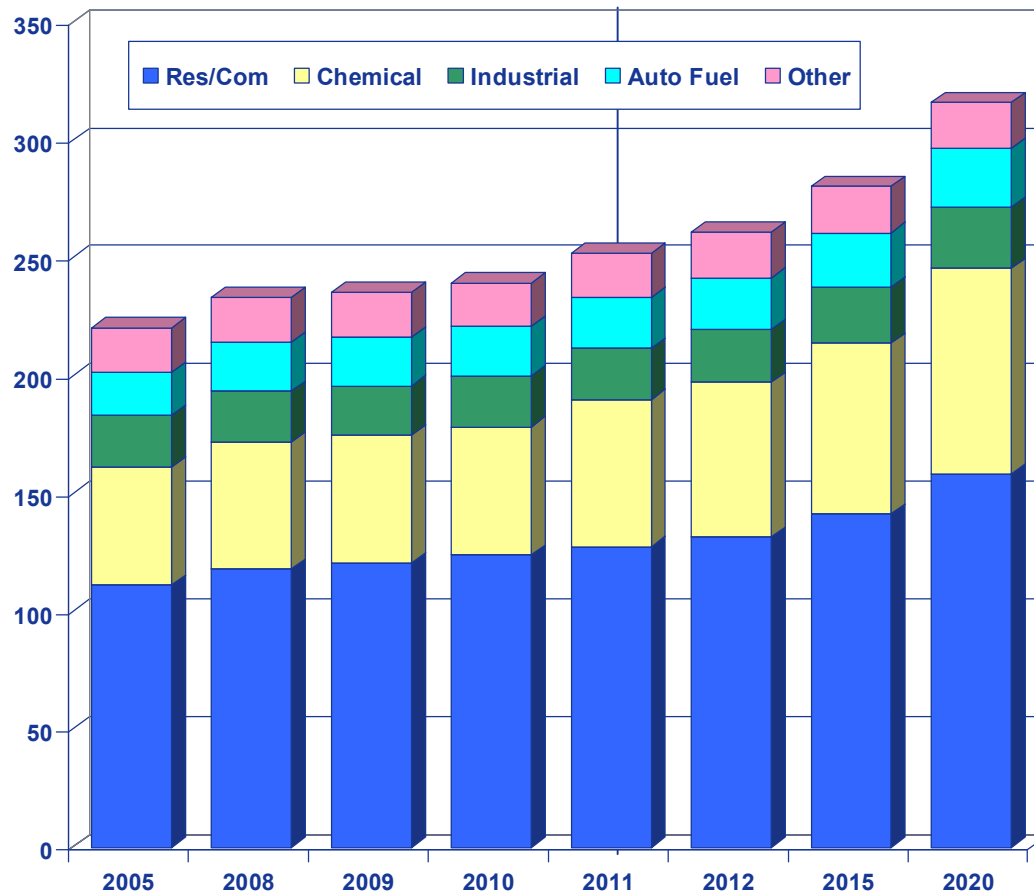
LPG Demand, Million Tonnes/Yr



- Ø Asia is the largest LPG consuming region in the world, and is still expanding.
- Ø The Middle East is becoming a more significant LPG demand center—driven by both the rapid expansion of the petrochemical industry and continued growth in the res/com sector.
- Ø LPG demand growth in North America and Europe are linked to the petrochemical industry.
- Ø Developing markets in Latin America and Africa will expand over time.

The Res/Com and Chemical Sectors Will Continue to Lead the Expansion of the Global LPG Market

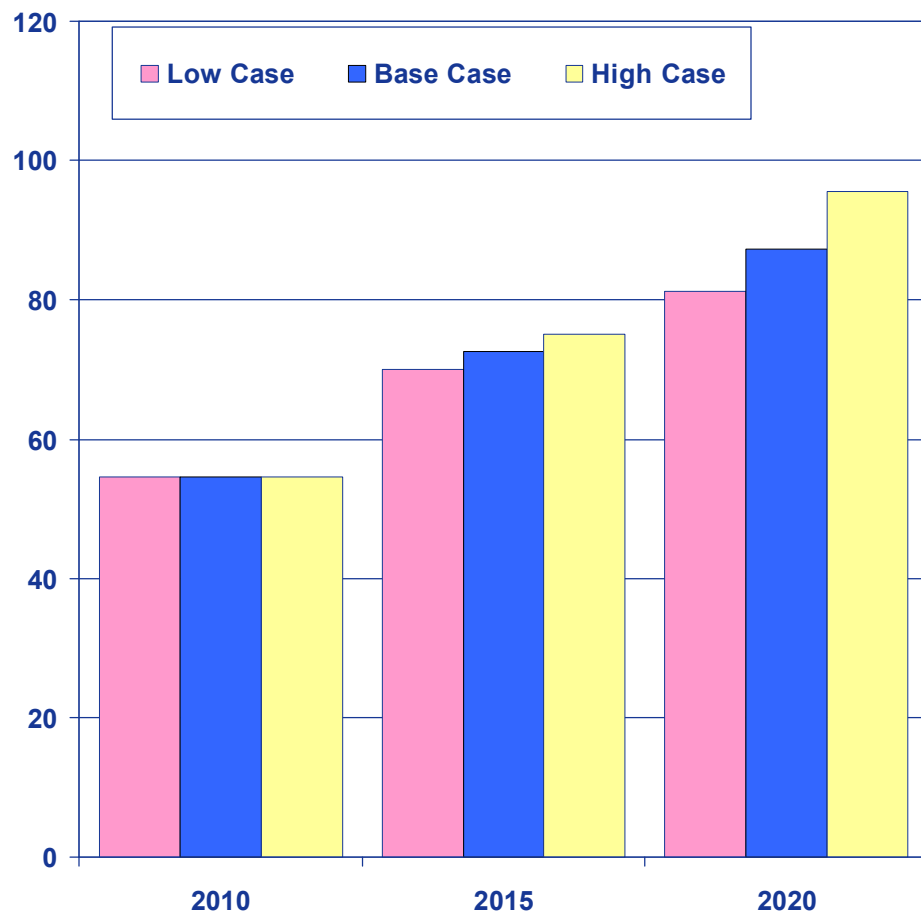
World LPG Demand, Million Tonnes/Yr



- ∅ The residential/commercial sector is the largest end-use market.
- ∅ Significant growth in the res/com sector is anticipated—but growth has slowed recently due to higher consumer prices & the economic slowdown.
- ∅ Chemical demand for LPG is fairly strong due to high oil/naphtha prices and large NGL-based olefin capacity additions in the Middle East.
- ∅ Future LPG market growth is very dependent on these two large end-use markets.
- ∅ Engine fuel markets also have high growth potential over the longer term.

Consumption of LPG As Petrochemical Feedstock Will Expand With Growth in Global LPG Supply

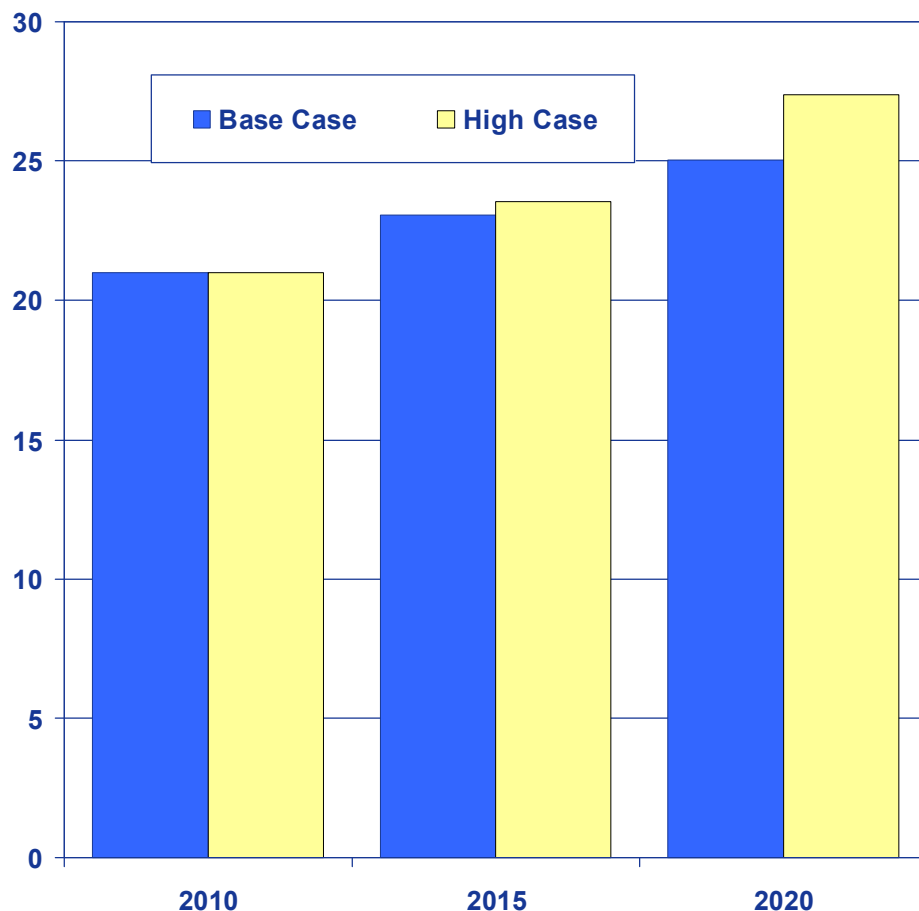
World LPG Chemical Demand, Million Tonnes/Yr



- Ø LPG is consumed as a feedstock in the global petrochemical industry.
- Ø There are two broad categories of demand:
 - § Base demand--This is structural demand where LPG is a steady source of feedstock (e.g. Middle East crackers)
 - § Price-sensitive demand-- LPG is substituted for other feedstocks such as naphtha based on short-term economic incentives.
- Ø In the base case, LPG consumption is expected to rise by almost 40 million tonnes per year.
- Ø However, demand in this sector can vary significantly depending on LPG supply availability and competition from other end-use markets (such as res/com).

Engine Fuel Markets for LPG Might Expand Faster Than Expected If Regulatory Policies Are Favorable

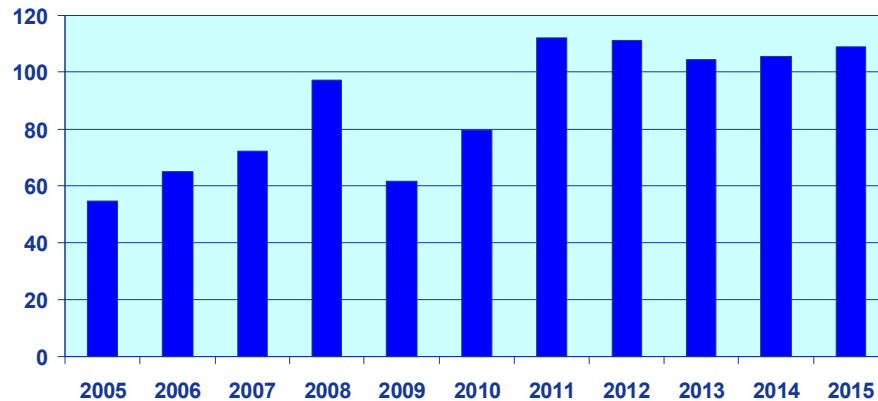
LPG Engine Fuel Demand, Million Tonnes/Yr



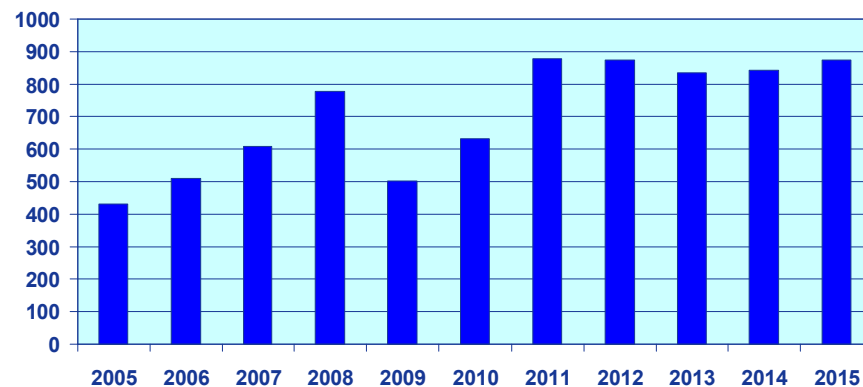
- Ø LPG use as engine fuel is very dependent on favorable government regulatory policies and excise tax systems.
- Ø Significant growth in the use of LPG as an engine fuel is included in the base case outlook—expanded use of LPG as a clean fuel in environmentally sensitive locations is expected.
- Ø Faster growth might result in the future if regional/global environmental initiatives gain more momentum.

Crude Oil and LPG Prices Are Expected to Stay Relatively Firm in the Future

Spot Brent Crude Oil, fob North Sea (\$/Bbl)



Middle East Contract LPG fob Arab Gulf (\$/Tonne)



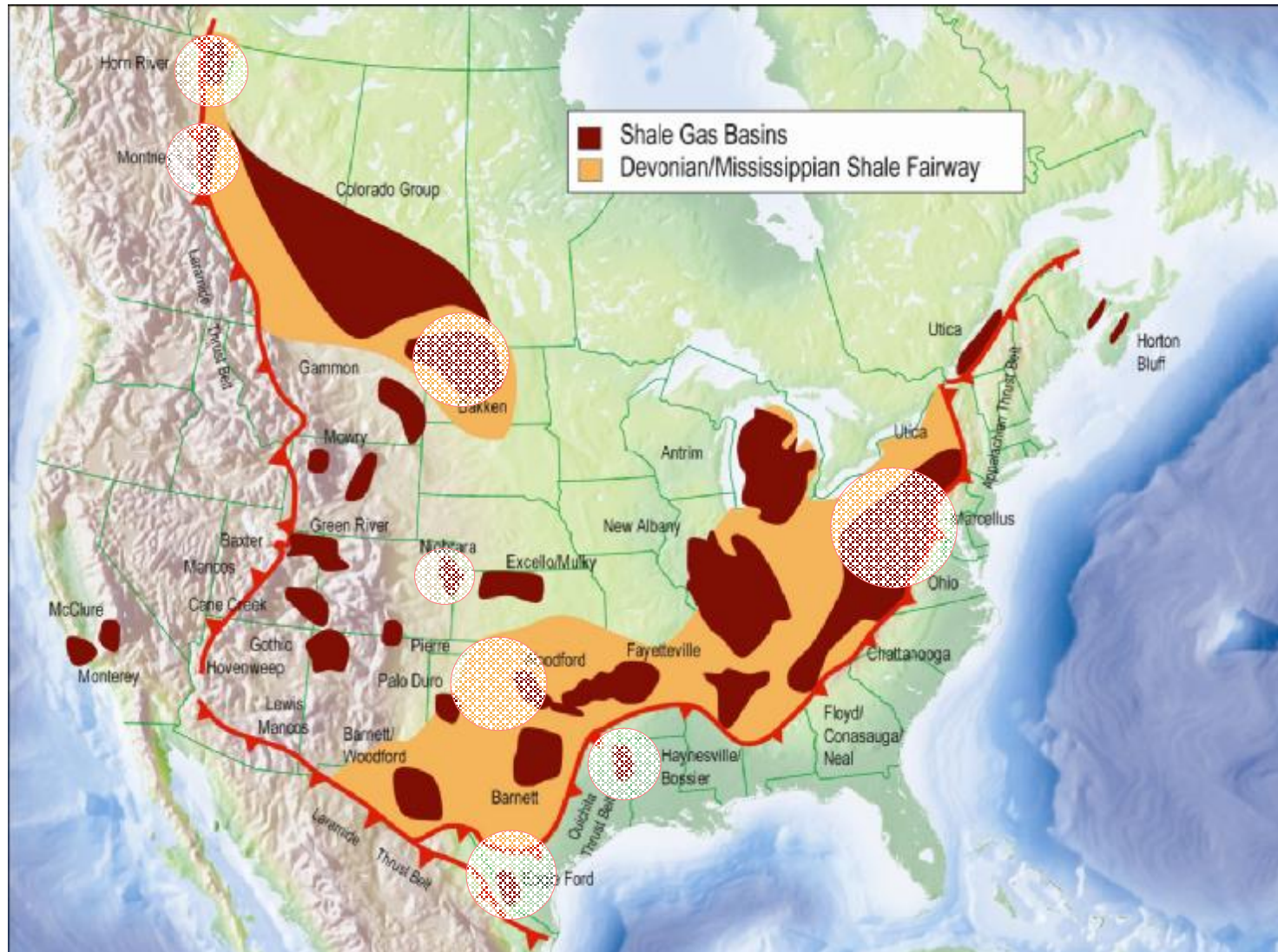
- Ø Crude oil prices will remain quite volatile—expected to trade in a range from \$80 to \$120/bbl.
- Ø Demand growth in Asia and the Middle East will keep some upward pressure on petroleum prices.
- Ø LPG prices are expected to be fairly high due to the strength in crude oil prices.
- Ø However, growth in international LPG supplies will exert some pressure on LPG to stay competitive with other petrochemical feedstocks, such as naphtha.
- Ø This competitive pressure will tend to moderate prices somewhat over the forecast period.

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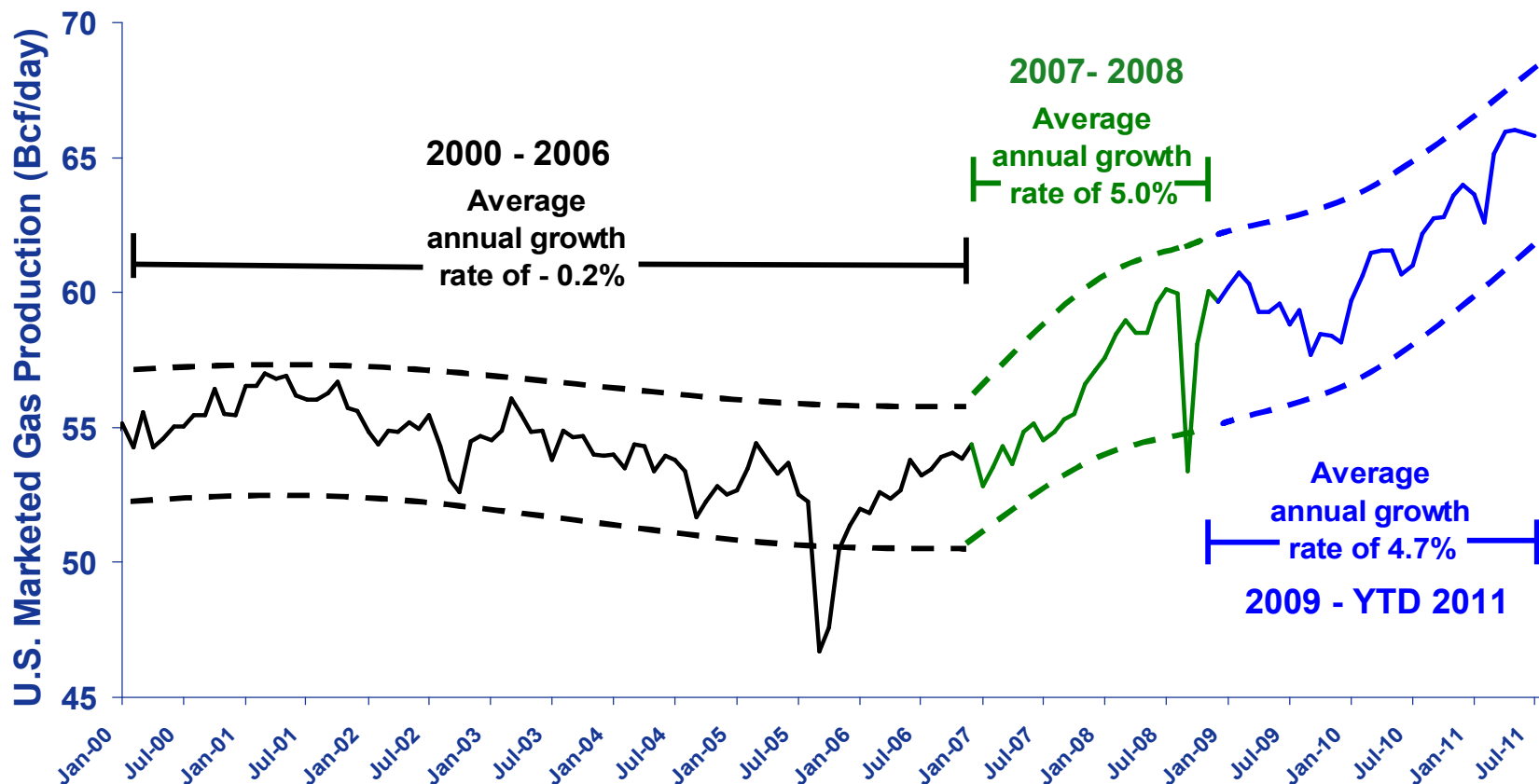
North American Shale Formations (Known – Technology Driven U.S. Gas Supply Response)



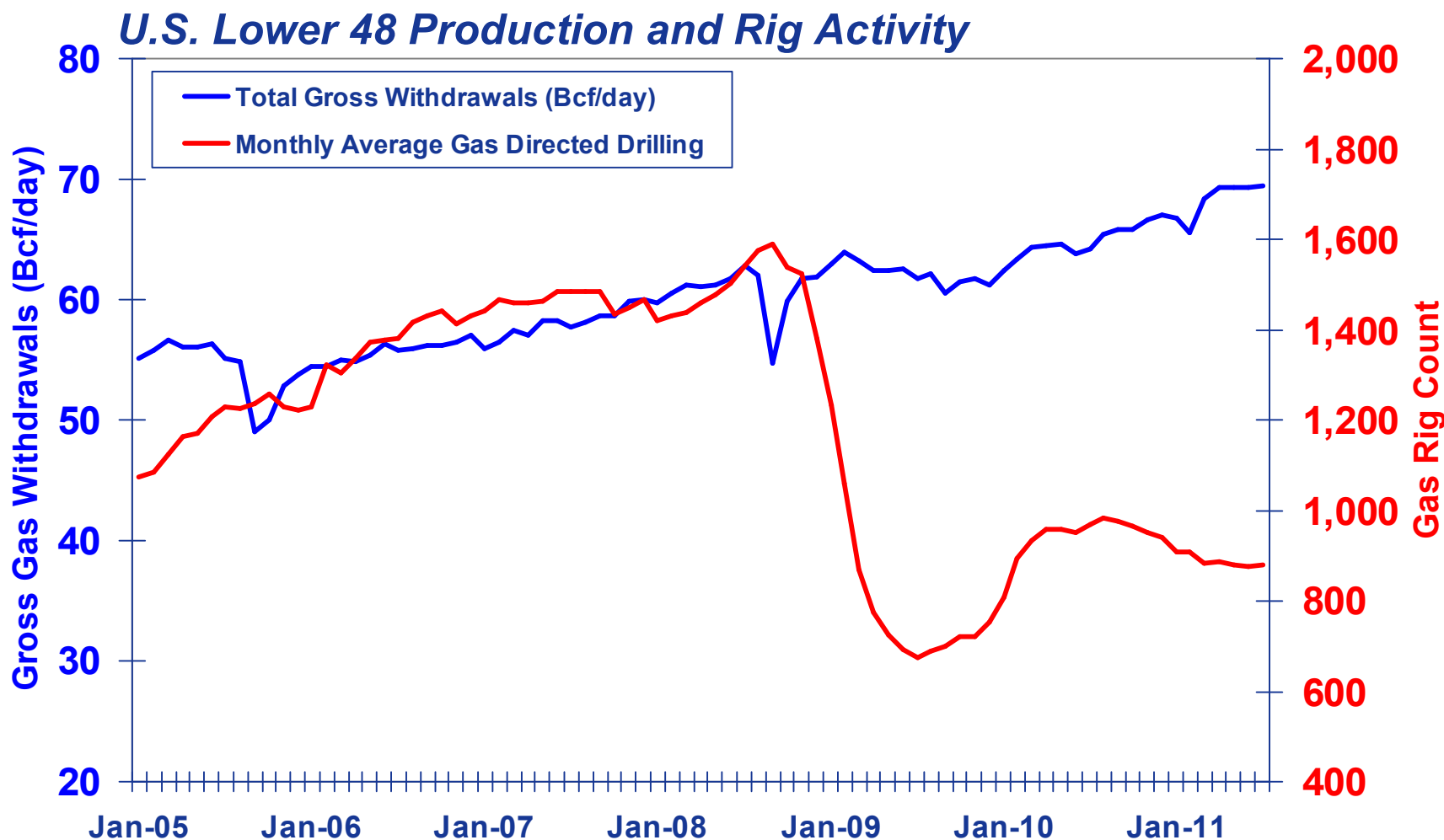
Source: PGI, National Energy Board

Shale Gas Impact On U.S. Marketed Gas Production (The “New” Supply Dynamic)

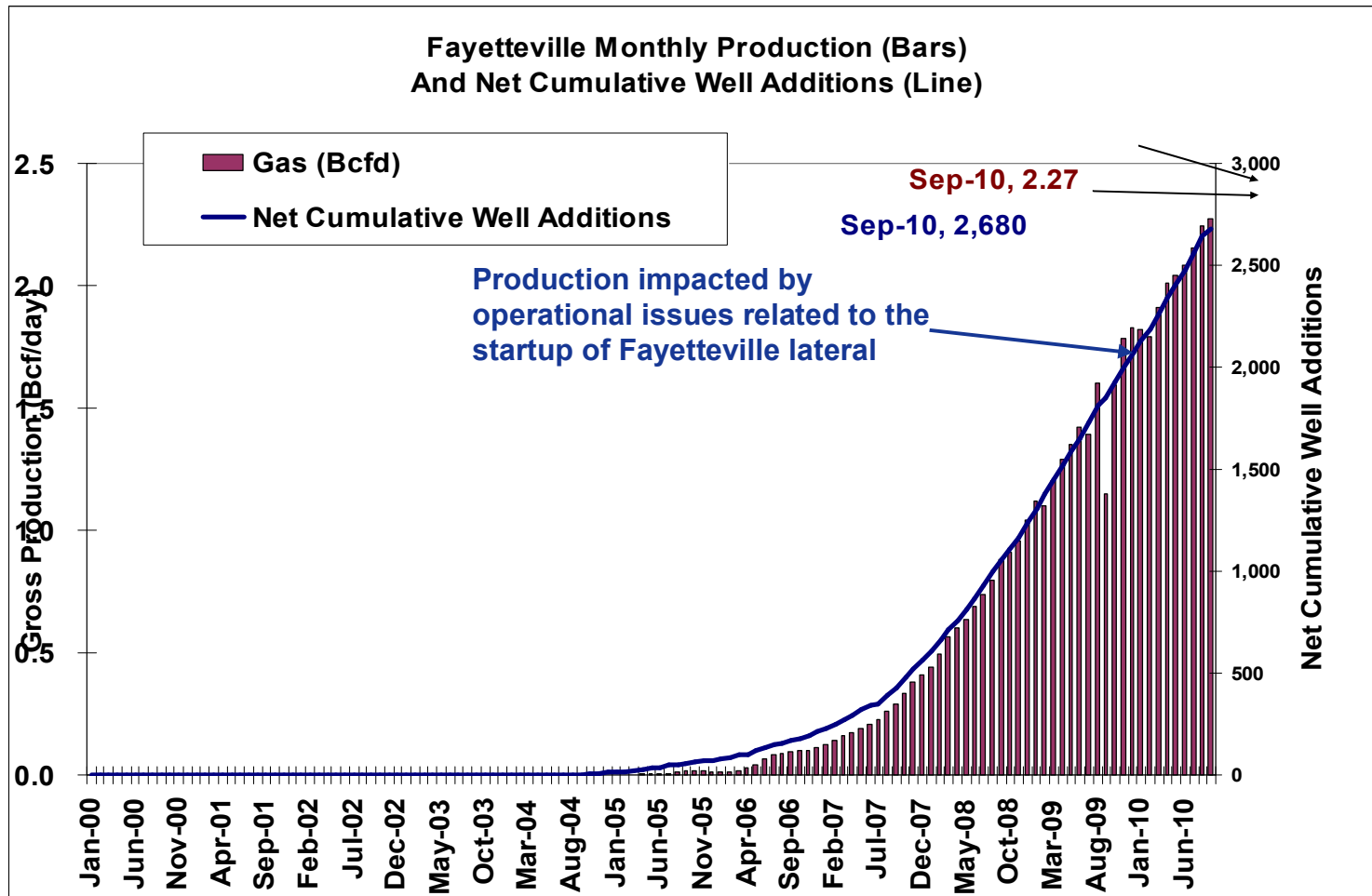
- Ø U.S. shale gas production’s prolific nature has resulted in a structural change in the U.S. gas market (no longer in decline)
- Ø Gas is abundant and can be produced at relatively low prices



U.S. Gross Gas Production Continues To Expand (In Spite Of Lower Drilling Activity Shale Gas Is “Booming”)

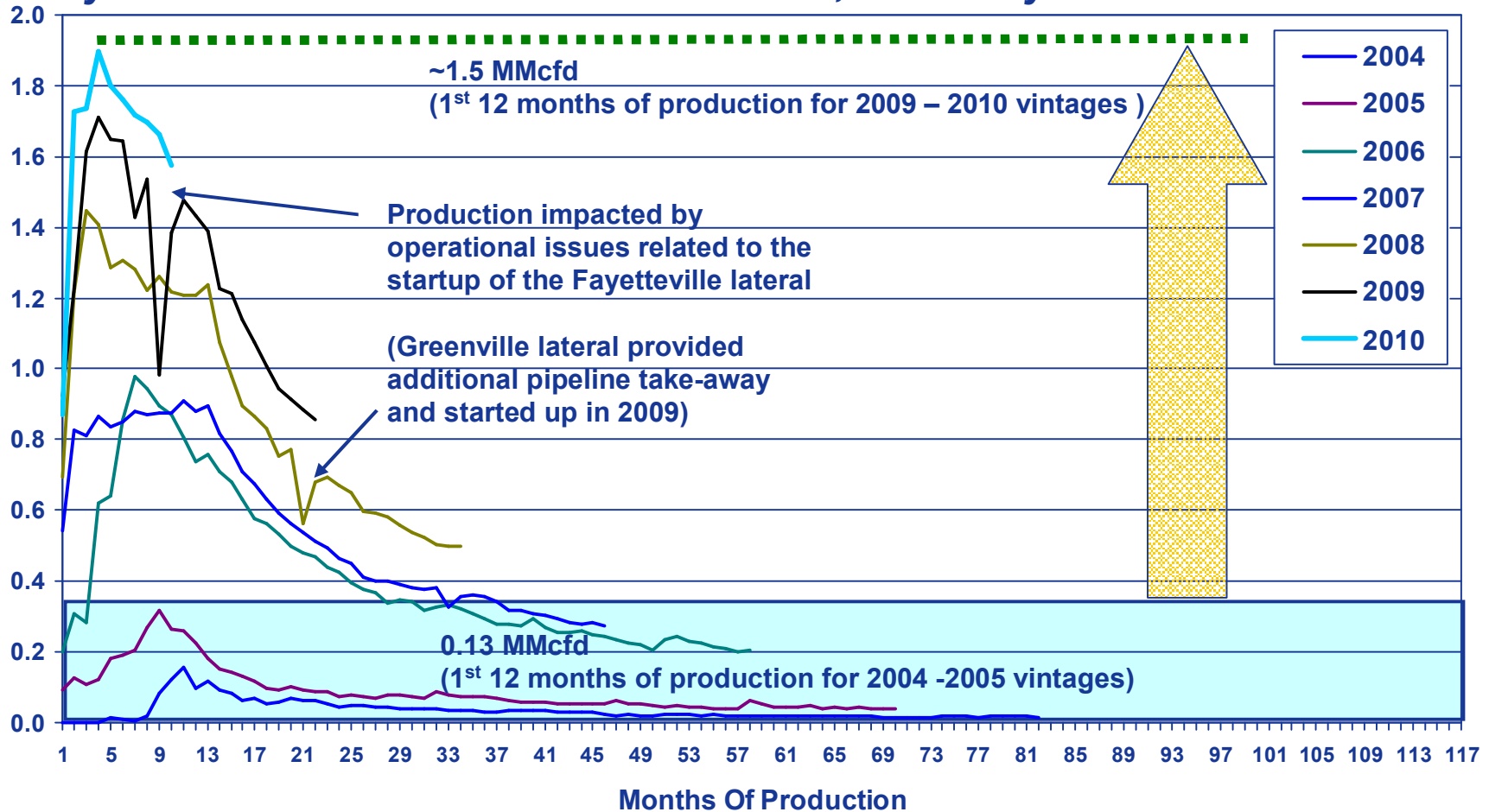


Fayetteville Shale Production (Shale Gas “Boom” Example)



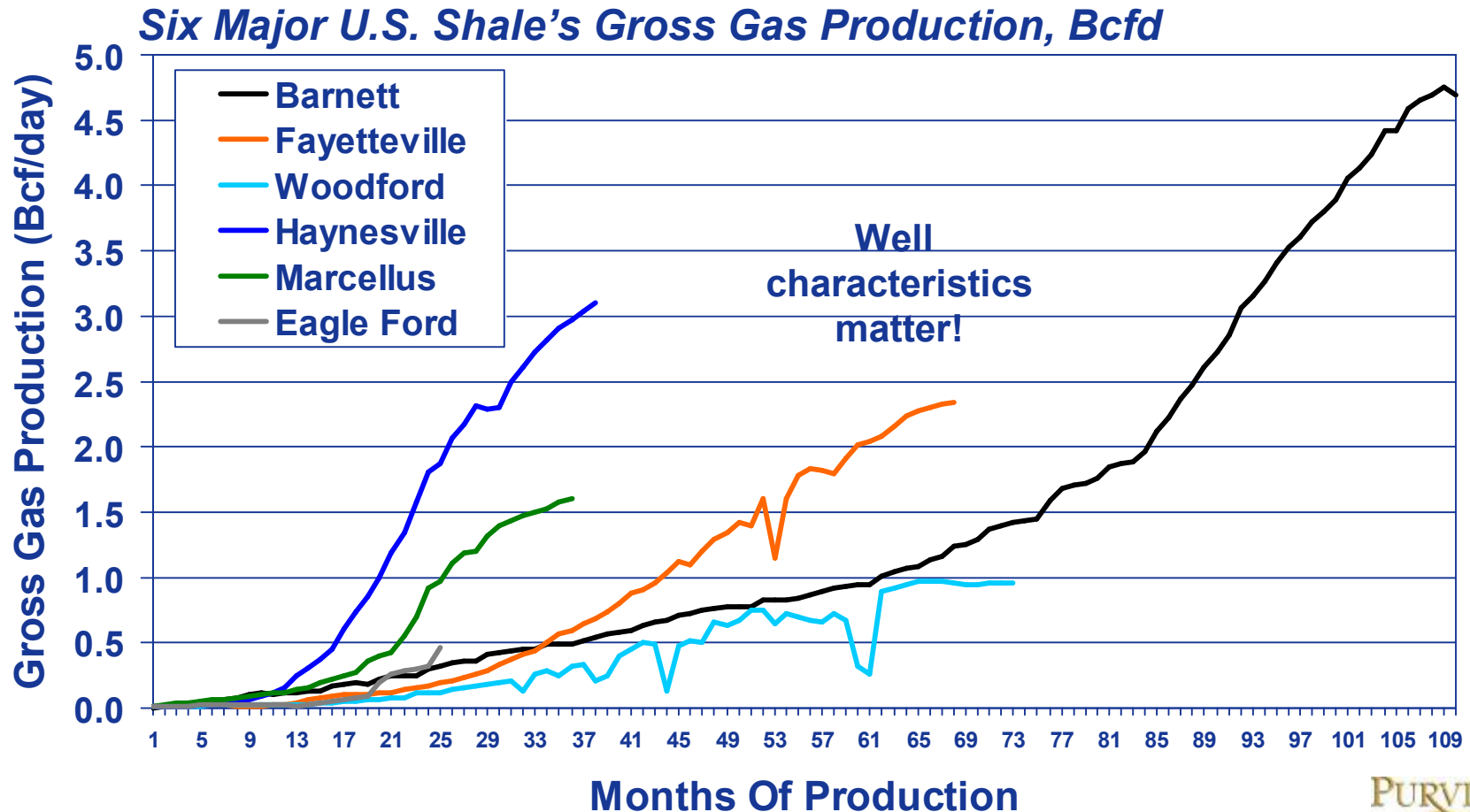
Fayetteville's Per Well Performance (Applying The Technology)

Fayetteville Shale Gross Gas Production, MMcf/day



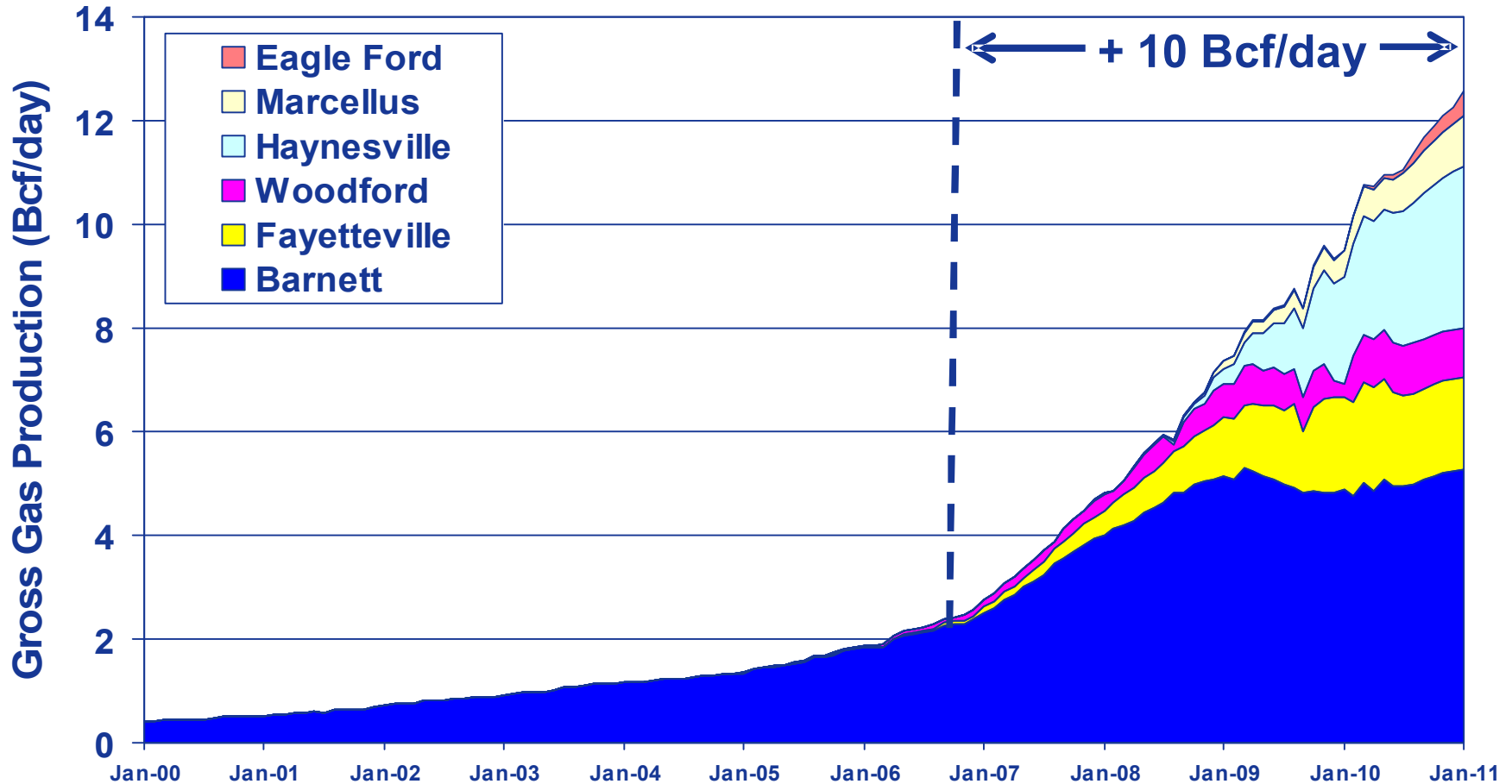
Major U.S. Shale Gas Plays' Time To Market

- Ø The time from spud to first gas sales has improved significantly – lessons learned are being transferred from one U.S. shale to the next
- Ø The “later shale plays” are achieving significant production rates of change assuming infrastructure additions keep up with drilling activity



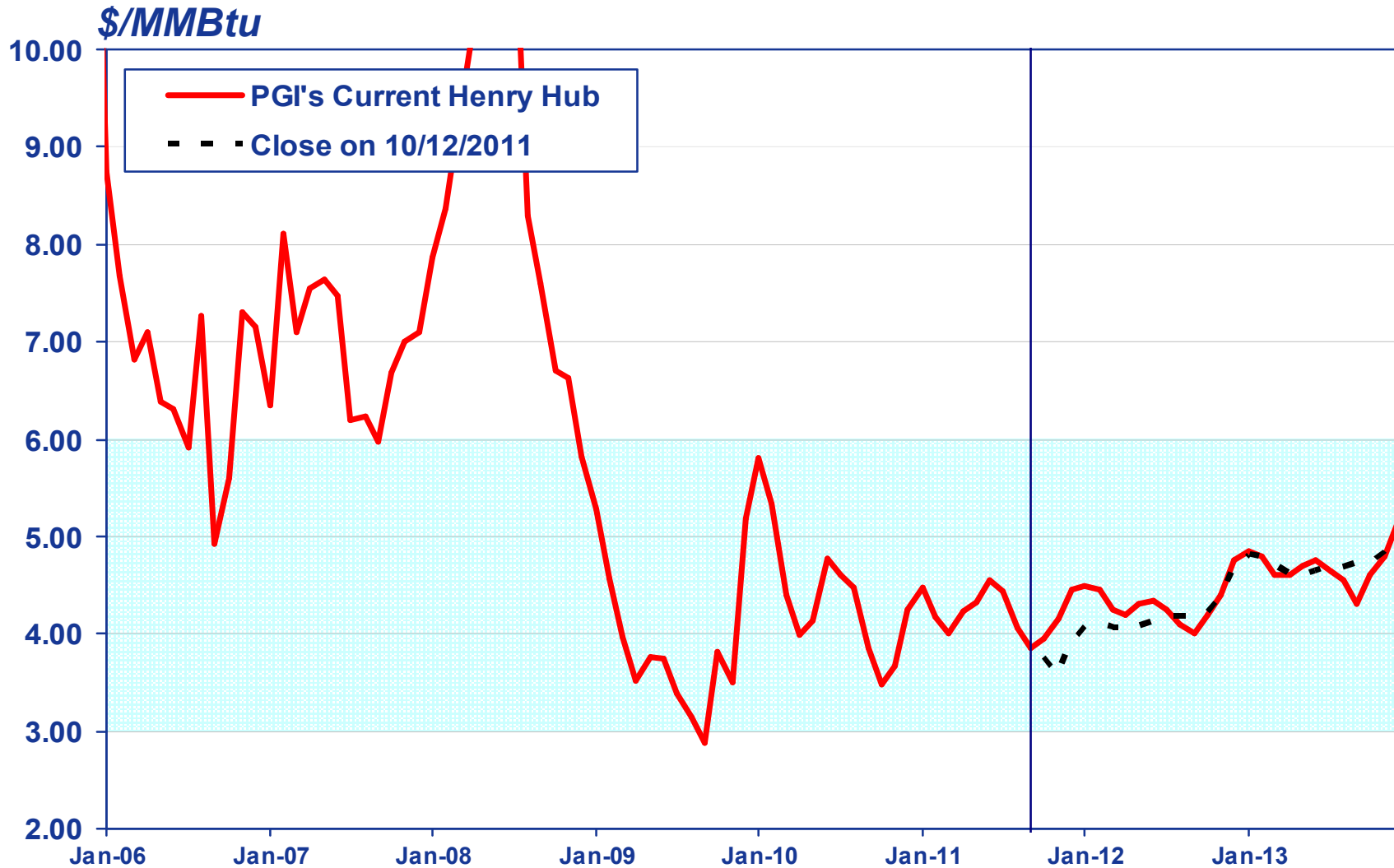
U.S. Shale Gas Production (Rapid Expansion – Under The “Right” Market Conditions)

Gross Gas Production, Bcf/day



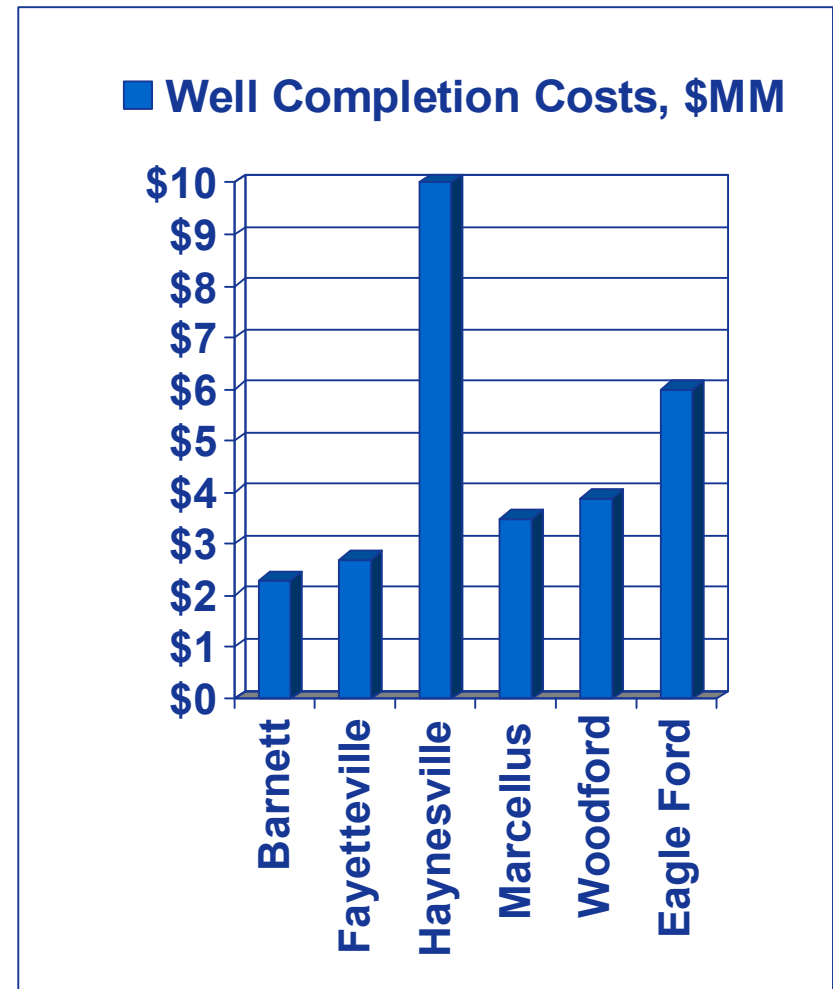
Source: PGI

The “New Gas Market” Is Attempting To Reach Equilibrium (Too Much Supply In The Short Run)



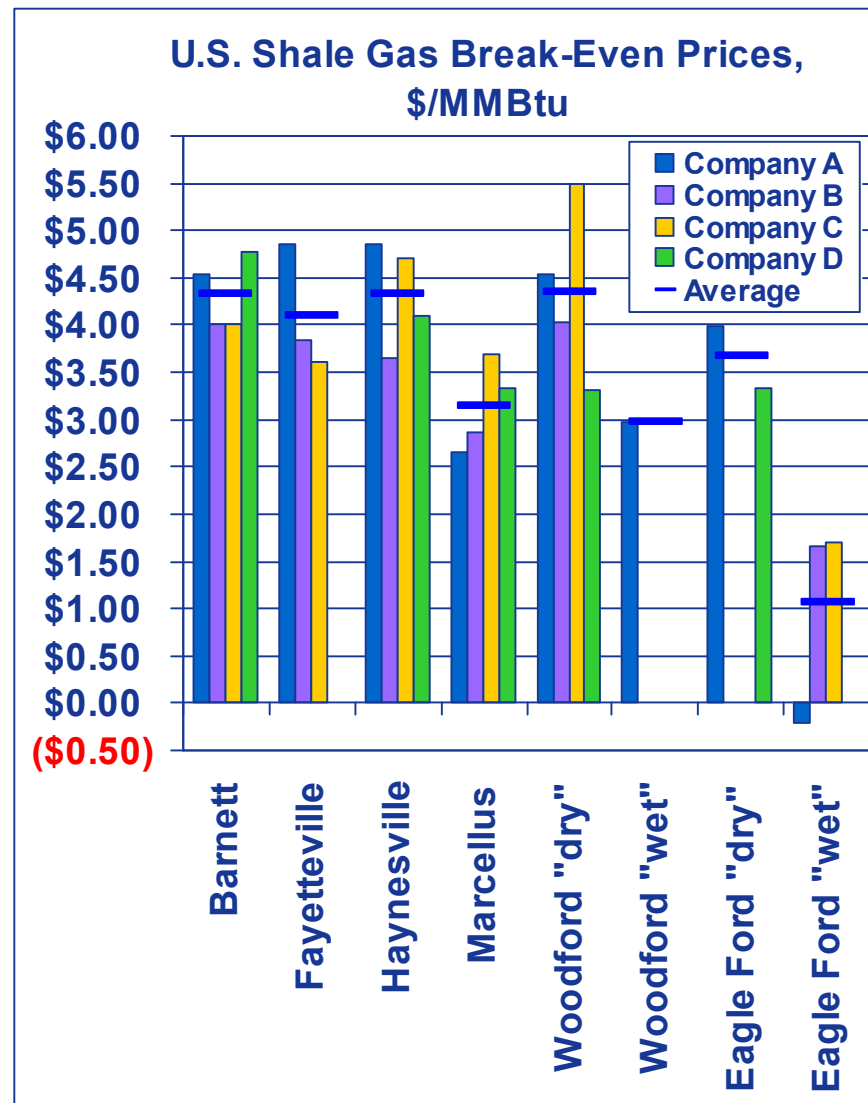
U.S. Shale Gas Horizontal Well Completion Costs (Significant Investments Are Required)

- Ø Horizontal drilling and hydraulic fracturing systems employed to specific shale gas drilling locations determines the specific well completion costs.
- Ø Shale gas formations' geological characteristics vary and therefore well completion costs vary.
- Ø Well completion costs for U.S. shale gas basins in 2010 are in the range of \$2.3 million to \$10 million per well.
- Ø The number of new non-associated U.S. shale gas wells expected to be completed and producing in 2011 is approximately 3,300. Of these new wells, 51% were located in Barnett.



U.S. Shale Gas Break-Even Prices (Primary Gas Production Growth Driver)

- Ø U.S. shale gas “break-even” price estimates vary depending on the inputs and assumptions applied.
- Ø Cost variables include well completion costs, estimated reserve size, lease costs, royalties, projected decline curves, NGL content/price forecast, overhead costs, minimum rate of return, etc.
- Ø Publicly available information indicates that the most economic U.S. shale gas plays are the Marcellus, Woodford “wet”, and Eagle Ford “wet” shales.
- Ø Non-associated gas with high NGL content can reduce the break-even price by as much as \$1.50 to \$2.00 per MMBtu.



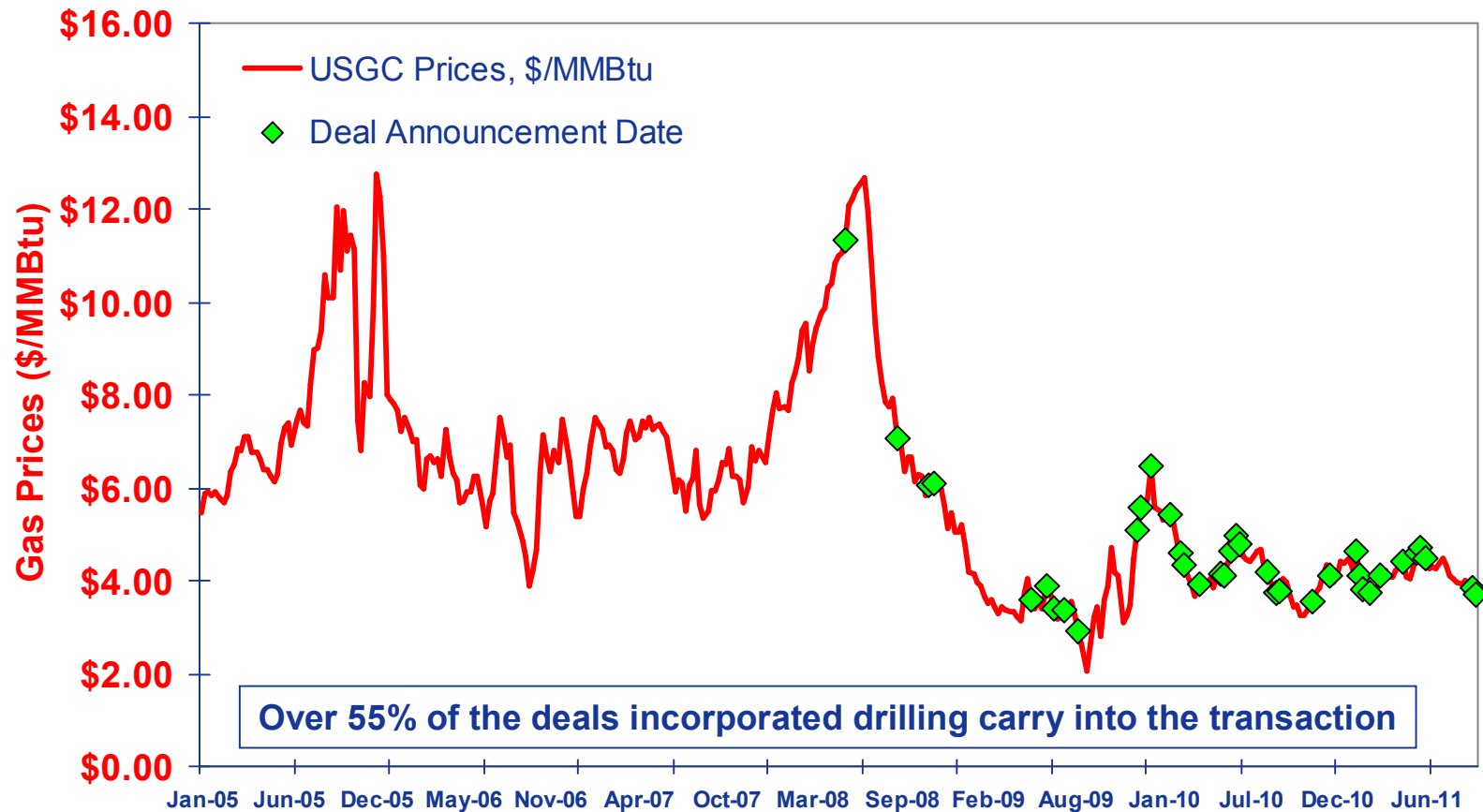
Shale M&A Activity: Taking A Long Term View (Secondary Production Growth Driver)

| Deal # | Announcement Date | Buyer | Seller | Region | Transaction Value (Billion) | Acreages (net acres) | Carry |
|---|-------------------|-----------------------------------|---------------------------------|-------------------------------|-----------------------------|----------------------|---------|
| 1 | 6/1/2008 | Plains Exploration & Production | Chesapeake Energy | Haynesville shale | \$3.30 | 550,000 | 50% |
| 2 | 7/14/2008 | Royal Dutch Shell | Duvernay Oil Co. | Montney shale | \$6.00 | 450,000 | Unknown |
| 3 | 9/2/2008 | BP America Inc. | Chesapeake Energy | Fayetteville shale | \$1.90 | 540,000 | 100% |
| 4 | 11/4/2008 | Avista Capital Partners | Carrizo Oil & Gas | Marcellus shale | \$0.15 | 155,000 | 50% |
| 5 | 11/11/2008 | StatoilHydro | Chesapeake Energy | Marcellus shale | \$3.38 | 1,800,000 | 75% |
| 6 | 5/18/2009 | Eni | Quicksilver Resources | Barnett shale | \$0.28 | 13,000 | 0% |
| 7 | 6/22/2009 | Williams Co. | Rex Energy | Marcellus shale | \$0.03 | 44,000 | 90% |
| 8 | 6/30/2009 | BG Group | Exco Resources Inc. | Haynesville shale | \$0.81 | 84,000 | 75% |
| 9 | 8/19/2009 | Enerplus Resources Fund | Chief Oil & Gas | Marcellus shale | \$0.41 | 540,000 | 60% |
| 10 | 12/14/2009 | Exxon Mobil Corp. | XTO Energy Inc. | Several shales | \$41.00 | 5,167,000 | N/A |
| 11 | 12/15/2009 | Sumitomo Corp. | Carrizo Oil & Gas | Barnett shale | \$0.02 | 10,000 | 12.5% |
| 12 | 1/4/2010 | Total E&P USA | Chesapeake Energy | Barnett shale | \$2.25 | 270,000 | 60% |
| 13 | 2/16/2010 | Mitsui E&P USA LLC | Anadarko Petroleum | Marcellus shale | \$1.40 | 100,000 | 100% |
| 14 | 3/1/2010 | Korea Gas Corp. | EnCana Corp. | Horn River and Montney shales | \$0.58 | Unknown | 100% |
| 15 | 3/2/2010 | BP America Inc. | Lewis Energy Group | Eagle Ford shale | \$0.20 | 80,000 | Unknown |
| 16 | 4/9/2010 | Reliance Industries Ltd. | Atlas Energy Ltd. | Marcellus shale | \$1.70 | 120,000 | 75% |
| 17 | 5/19/2010 | Talisman Energy | Common Resources LLC | Eagle Ford shale | \$0.36 | 37,000 | N/A |
| 18 | 5/28/2010 | Royal Dutch Shell | East Resources | Marcellus shale | \$4.70 | 650,000 | N/A |
| 19 | 6/14/2010 | Kohlberg Kravis Roberts | Hilcorp Resources | Eagle Ford shale | \$0.40 | 100,000 | 40% |
| 20 | 6/24/2010 | Reliance Industries Ltd. | Pioneer Natural Resources | Eagle Ford shale | \$1.36 | 95,400 | 75% |
| 21 | 6/25/2010 | China National Petroleum Corp. | EnCana Corp. | Horn River and Montney shales | Unknown | N/A | N/A |
| 22 | 8/24/2010 | Mitsubishi Corp. | Penn West Energy Trust | Montney shale | \$0.24 | N/A | N/A |
| 23 | 8/31/2010 | Sumitomo Corp. | Rex Energy | Marcellus shale | \$1.20 | 22,000 | 30% |
| 24 | 9/10/2010 | Reliance Industries Ltd. | Carrizo Oil & Gas | Marcellus shale | \$0.07 | 10,440 | 80% |
| 25 | 11/9/2010 | Chevron Corp. | Atlas Energy Inc. | Marcellus shale | \$4.30 | 1,200,000 | N/A |
| 26 | 12/20/2010 | Sasol Ltd. | Talsiman Energy | Montney shale | \$1.07 | 51,000 | 75% |
| 27 | 2/9/2011 | PetroChina Intl. Invest. Co. Ltd. | EnCana Corp. | Cutbank Ridge gas assets | \$5.43 | Unknown | Unknown |
| 28 | 2/16/2011 | CNOOC Ltd. | Chesapeake Energy | DJ and Powder River basins | \$0.70 | 800,000 | 67% |
| 29 | 2/22/2011 | BHP Billiton Ltd. | Chesapeake Energy | Fayetteville shale | \$4.75 | 487,000 | N/A |
| 30 | 3/4/2011 | Legend Natural Gas IV LP | Range Resources Corp. | Barnett shale | \$0.90 | 52,000 | N/A |
| 31 | 3/21/2011 | Korean National Oil Co. | Anadarko Petroleum | Eagle Ford shale | \$1.15 | 80,000 | 90% |
| 32 | 5/4/2011 | Chevron Corp. | Chief Oil & Gas and Tug Hill | Marcellus shale | \$1.60 | 228,000 | Unknown |
| 33 | 6/3/2011 | Petronas | Progress Energy Resources Corp. | Montney shale | \$1.10 | 149,910 | 75% |
| 34 | 6/8/2011 | Exxon Mobil Corp. | Phillips Resources and TWP Inc. | Marcellus shale | \$1.70 | 317,000 | Unknown |
| 35 | 6/21/2011 | CNOOC Ltd. | Chesapeake Energy | Eagle Ford shale | \$1.08 | 198,000 | 75% |
| 36 | 9/30/2011 | Gail | Carrizo Oil & Gas | Eagle Ford shale | \$0.30 | 4,040 | 100% |
| 37 | 10/3/2011 | Noble Energy Inc. | CONSOL Energy Inc. | Marcellus shale | \$1.00 | 314,000 | 100% |
| Total | | | | | \$96.8 | | |
| Total: Shale Only (Excluding ExxonMobil purchase of XTO Energy and Phillips Resources/TWP Inc.) | | | | | \$48.0 | | |

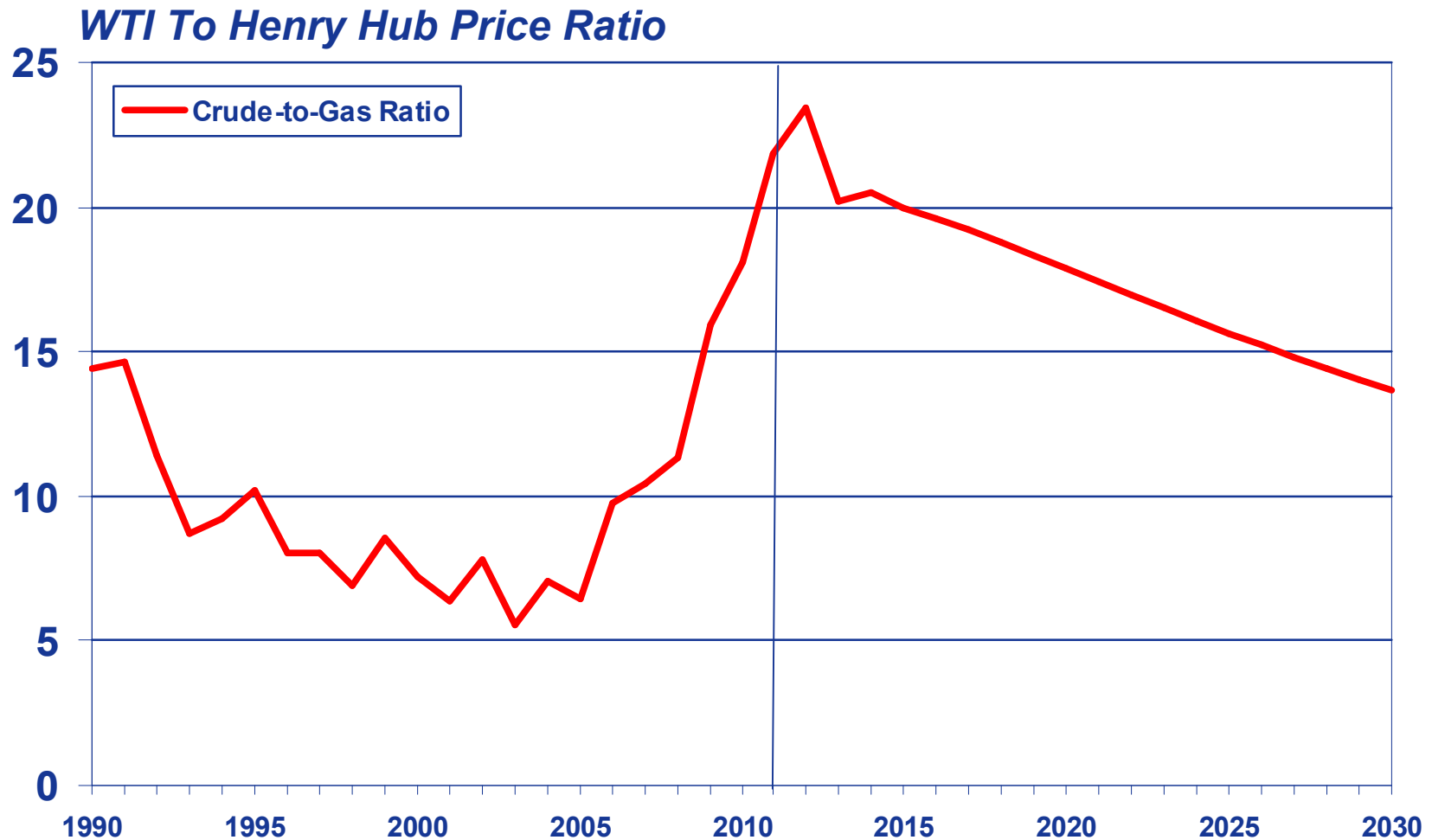
35 of 37 deals have involved shale gas acreage and production... this list excludes VPP deals

Shale M&A Activity (Buy Low And Sell High or Higher?)

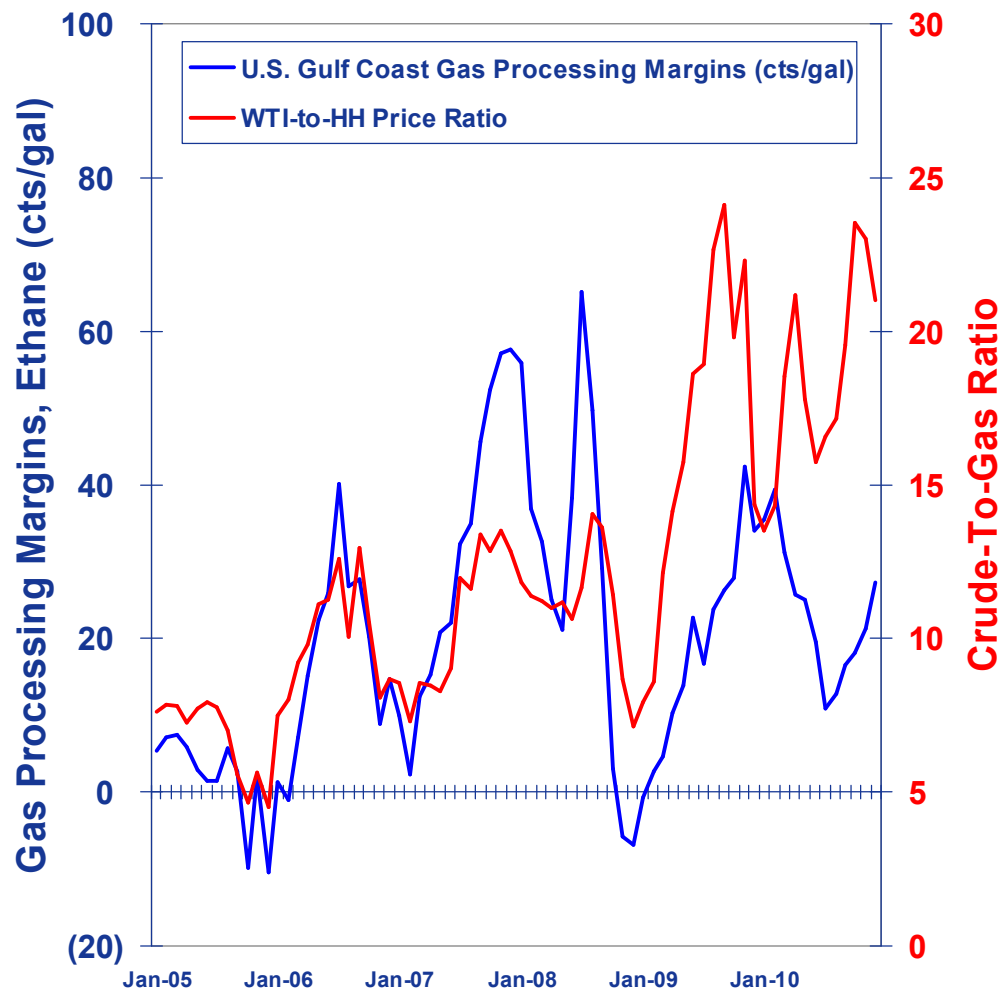
- Ø M&A activity will translate into midstream expansions and keep gas production at relatively high levels in spite of the current low gas pricing environment



Differences Between Crude And Gas Prices (Another Production Growth Driver – Liquids Uplift)

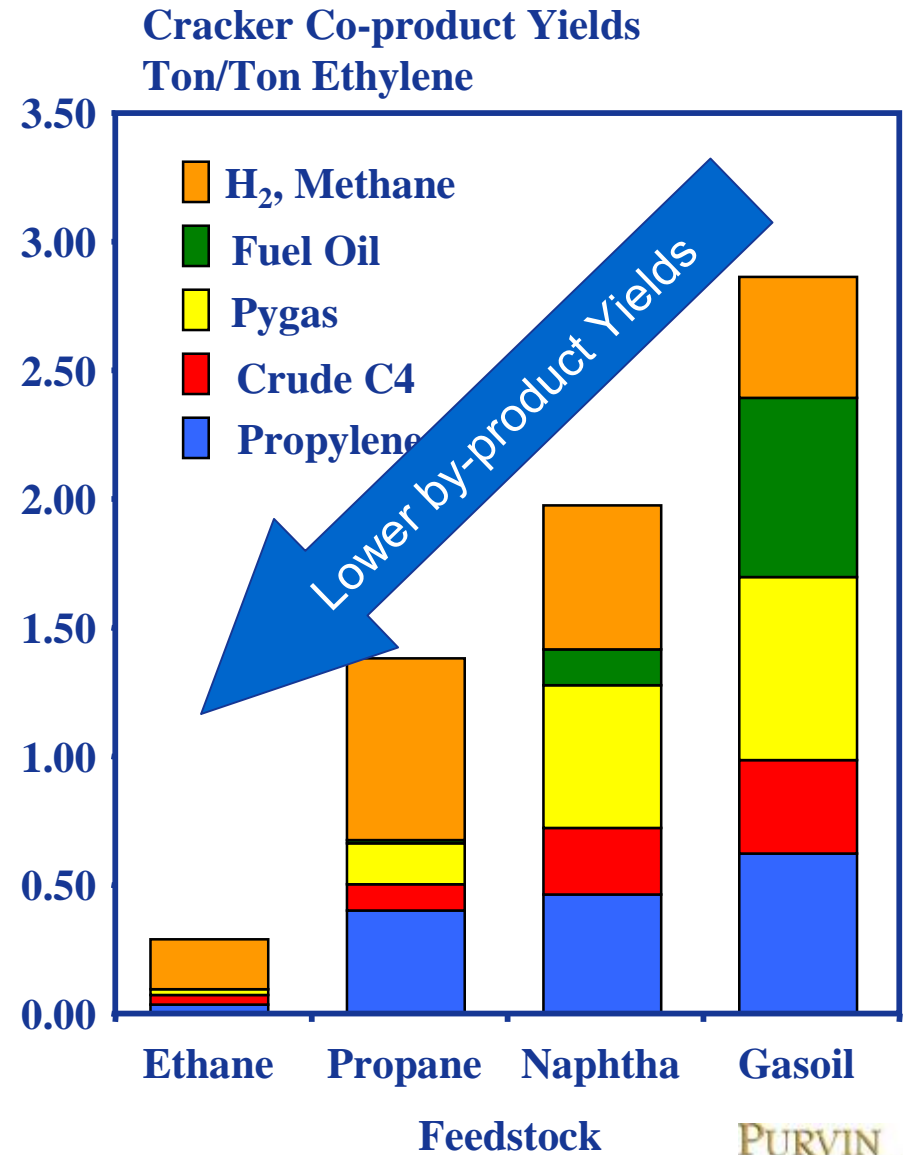
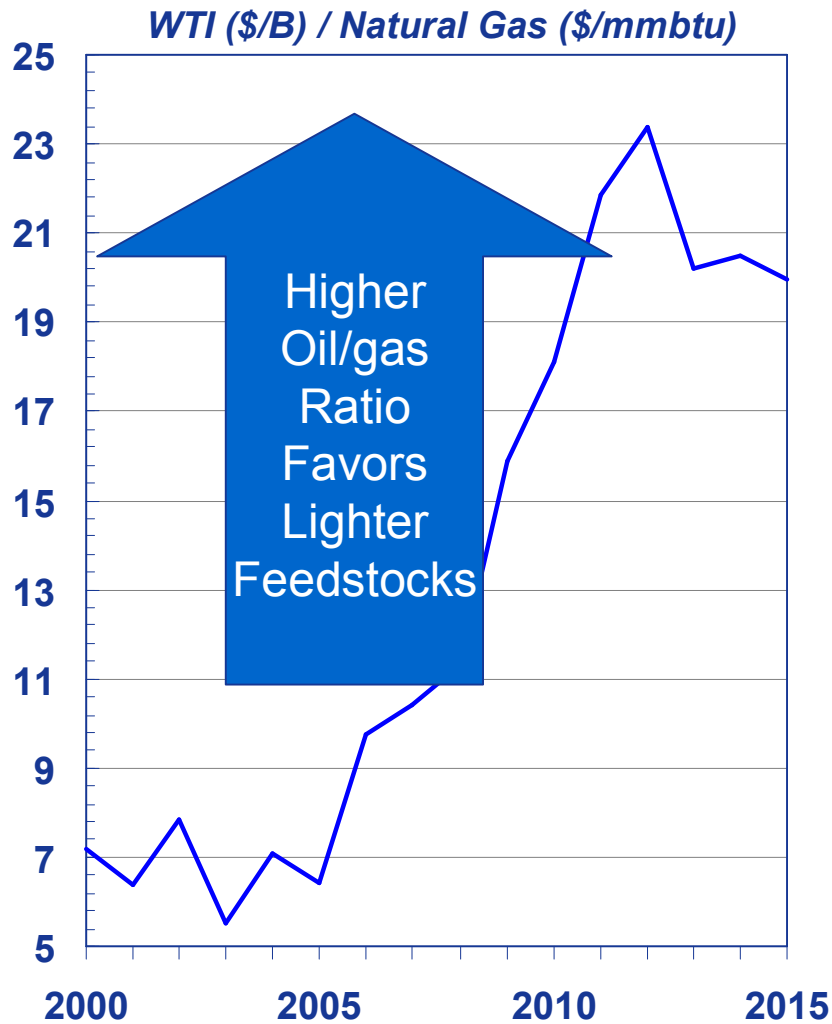


Producers, Midstream Business Will Benefit (Petrochemicals?)

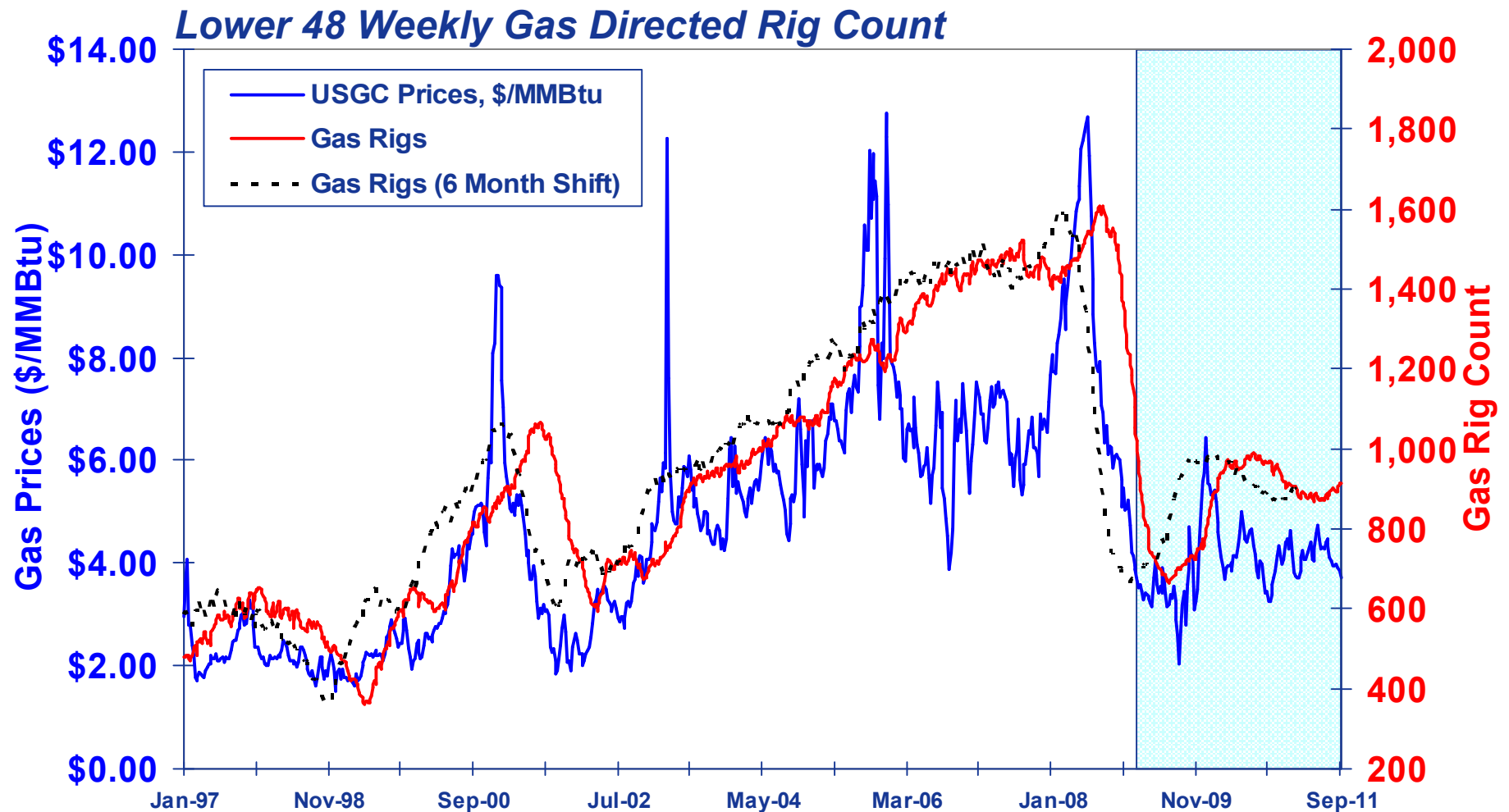


- ∅ The differences between the gas and crude oil markets manifest itself in the petrochemical feedstock market and the margin to gas processors (frac spreads)
- ∅ Gas processing margins for U.S. Gulf Coast processors extracting ethane depend on the crude-to-gas ratio and specific events in the short term
 - § Market related events within the gas markets, ethane end-use markets, crude prices, etc.
- ∅ Long term shifts in U.S. processing margins depend on the fundamentals of the global oil and North American gas markets

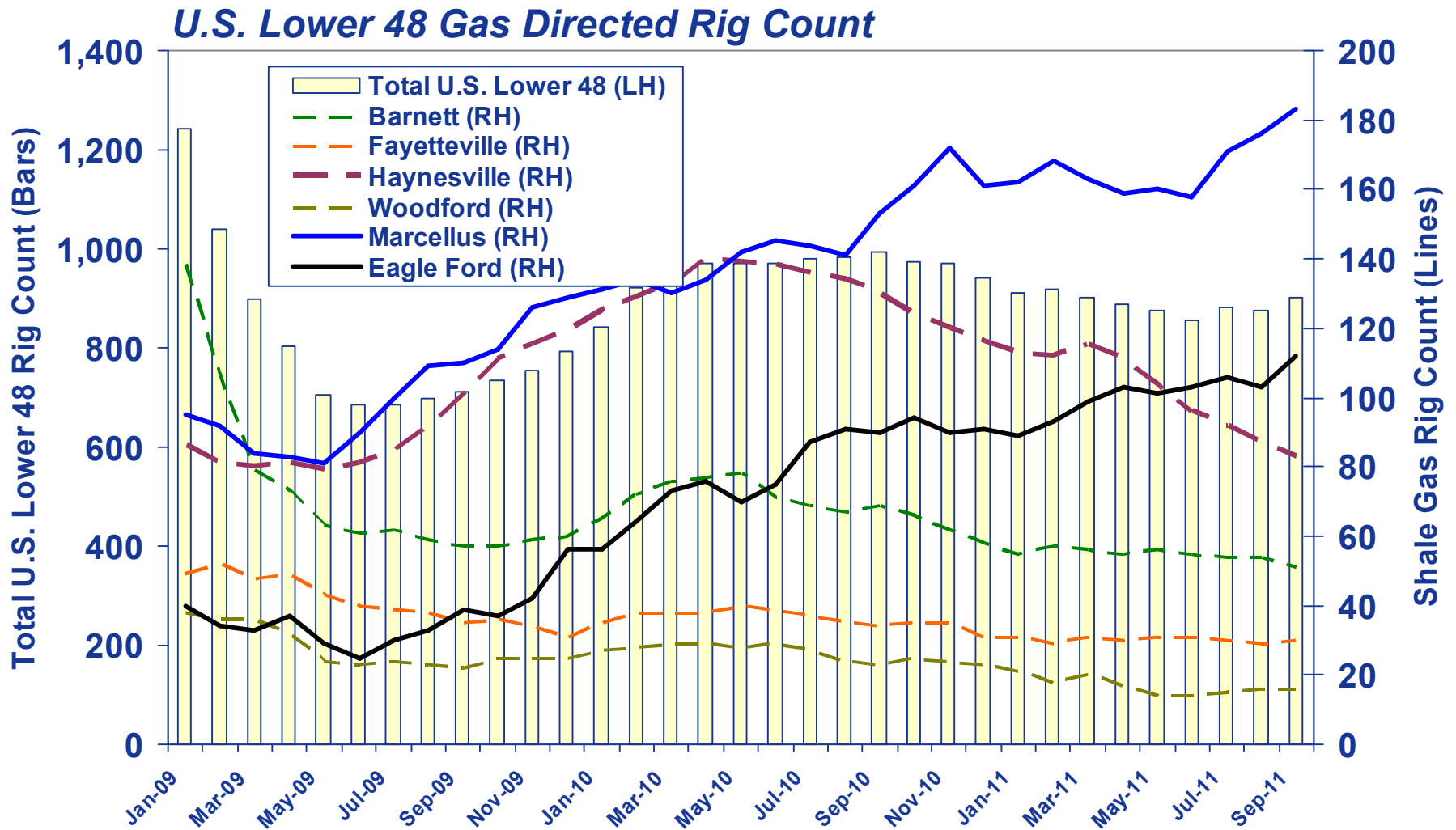
Cheap US natural gas is creating opportunities and challenges for NA petrochemical industry



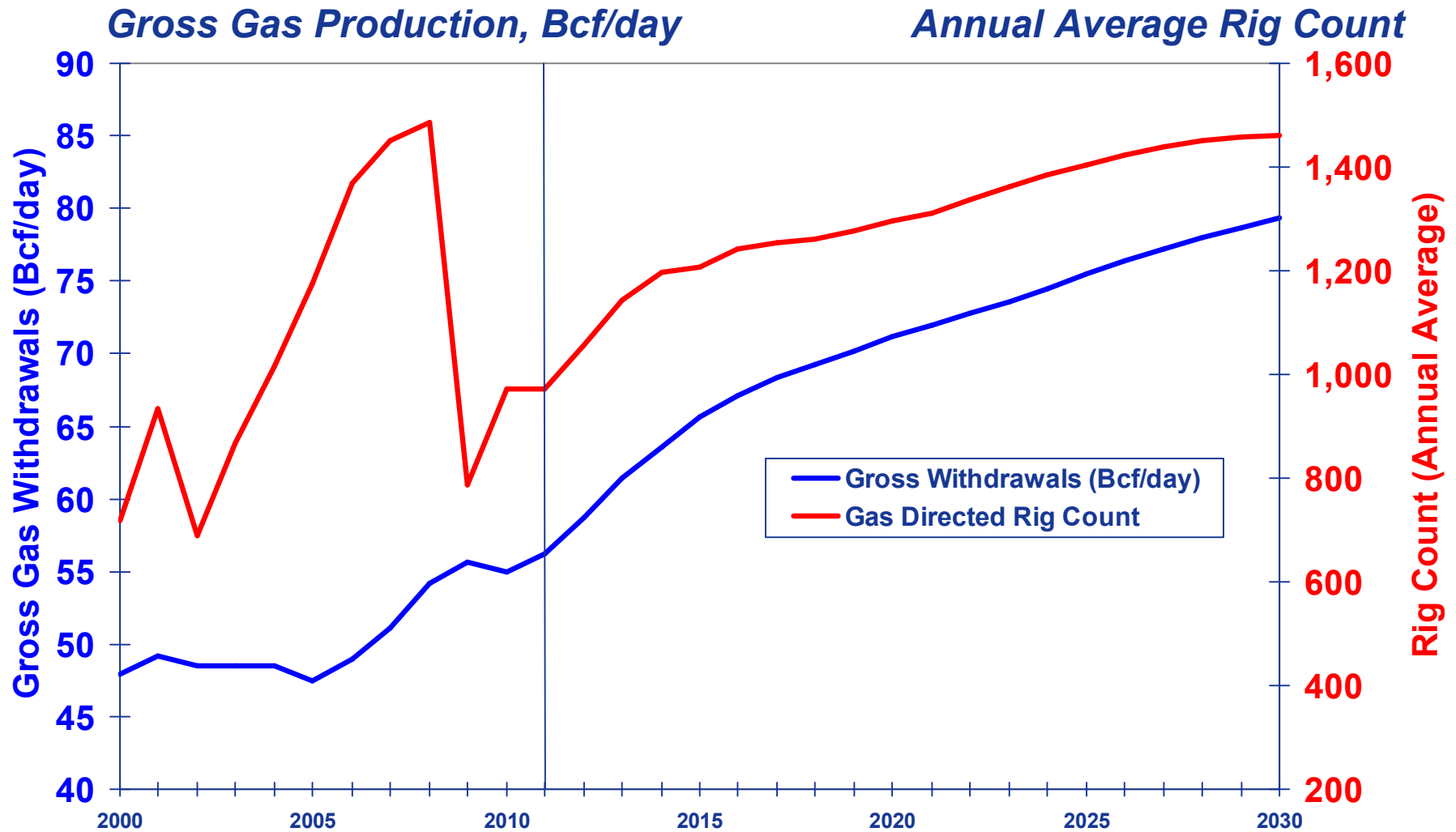
Gas Rig Activity And Responsiveness To Price (A New Paradigm – Participants Taking A Longer Term View)



U.S. Lower 48 Gas Directed Drilling (Near Term Drivers Are Evident – Positioning For LT Growth)



U.S. Lower 48 Gas Rig Activity & Non-Associated Production (The Expansion Will Likely Continue – Demand Limited)



Summary & Conclusions

- Ø **Economic uncertainty exists and slower GDP growth is expected over the next few years**
- Ø **Crude qualities are changing**
- Ø **N.A. crude oil supplies and logistics capabilities are impacting prices, margins, and U.S. refineries' utilization rates and profitability (additional refinery closures are expected)**
- Ø **Global LPG production has recovered and is expected to expand by more than 30 million tonnes per year over the next few years**
- Ø **U.S. shales production (oil and gas) are impacting regional gas and NGL, global LPG, and global LNG markets**

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