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Unconventional Resource Development in the United States (and the Japanese Case for Shale Gas)

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UNCONVENTIONAL RESOURCE DEVELOPMENT IN THE US

- Unconventional Resource Plays, Generally
- Transaction Structure
- Other Agreements/Documents
- Joint Operations
- Title and Land
- Diligence
- Modification of AAPL Model Form Operating Agreement
- Miscellaneous
- Alternative Approaches to Acquiring Reserves

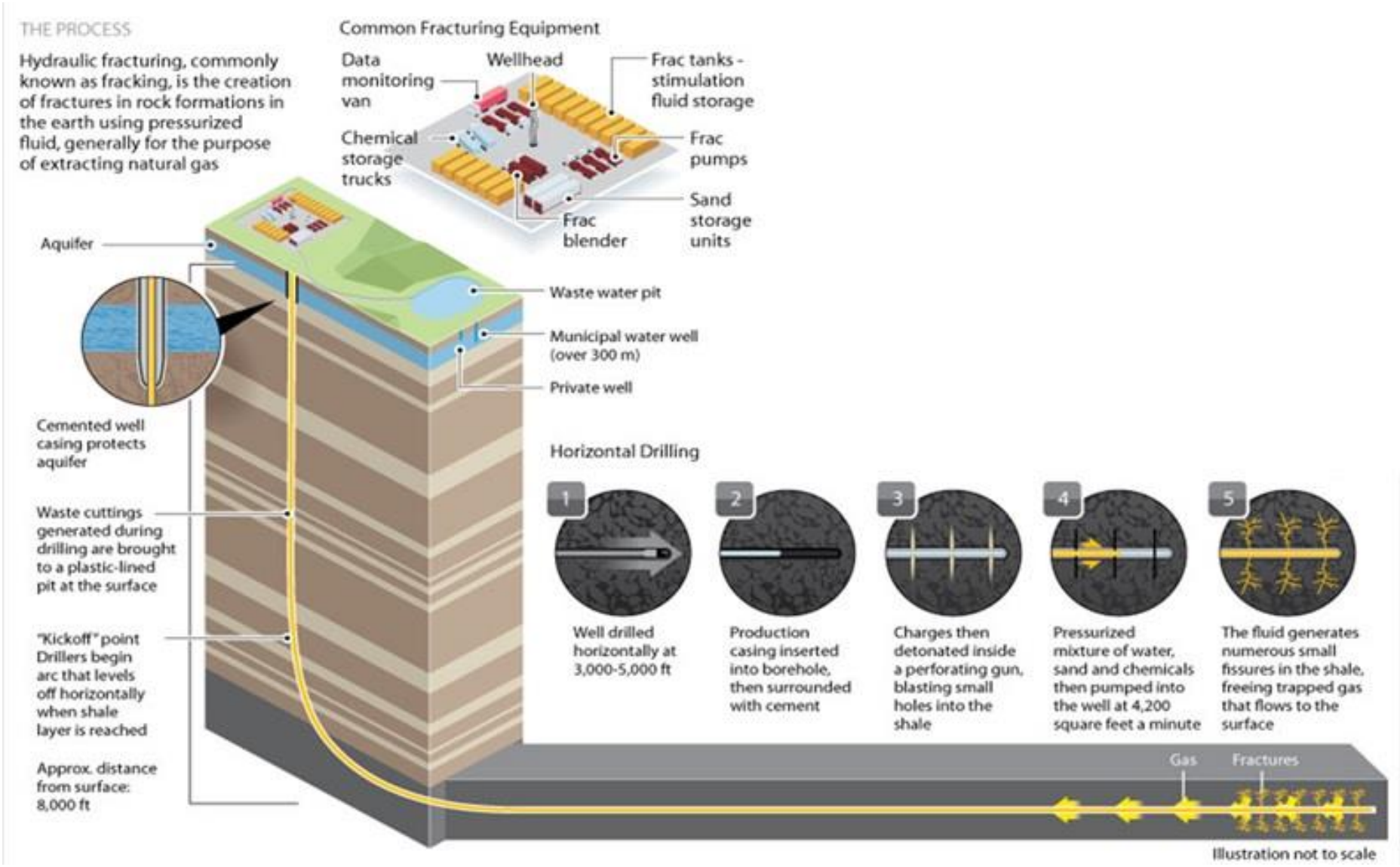
UNCONVENTIONAL RESOURCE PLAYS, GENERALLY

- Large-scale and continuous, but tight (low permeability), formations
- Traditionally viewed as source rock, as opposed to as reservoir rock
- Historically considered unviable
- Advances in technology = economic viability

UNCONVENTIONAL RESOURCE PLAYS, GENERALLY (CONT.)

- Horizontal drilling combined with hydraulic fracturing opened door to development
  - Significant advantages to horizontal wells
    - Exposes more of wellbore to target formation
    - Lessens environmental footprint
  - Hydraulic fracturing is key
    - Water, sand and chemical agent pumped at high pressure fractures target formation
    - Proppant (sand) holds open fractures
    - Typically done in multiple stages (“multi-stage hydraulic fracturing”)
- Sensitive to commodity prices, ability to continue drilling, and water issues
  - Production profile tends to be high initially, with quick decline and a gradual leveling out
  - Fracing uses large quantities of water
  - Creates issues regarding water sourcing and disposal

UNCONVENTIONAL RESOURCE PLAYS, GENERALLY (CONT.)



TRANSACTION STRUCTURE

- Implementation of terms
  - Purchase and Sale Agreement (acquisition)
  - Joint Development Agreement
    - Terms of Carry
    - Governance
    - Project level issues
  - Joint Operating Agreement
    - Operations
    - Operational level issues
    - Typically based on 1982 or 1989 AAPL form
    - Contract Area vs. Unit-by-Unit vs. Well-by-Well

TRANSACTION STRUCTURE (CONT.)

- Amount of interest being sold
- Consideration typically in the form of “cash and carry”
- Amount of cash paid upfront
- Amount of seller’s costs to be carried
- Coverage of the carry
  - Drilling, completing and equipping wells
  - Operating expenses
  - Horizontal wells in target formation
  - Exclusion of liabilities, damages, etc.

TRANSACTION STRUCTURE (CONT.)

- Length of the carry
  - Expenditure of entire carry consideration
  - Defined time period
  - Extension due to lower commodity pricing
- Tax Partnership needed to capture tax benefits associated with the carry
- Treatment of formations other than the target formation – alignment issue
- Treatment of midstream assets – alignment issue

OTHER AGREEMENTS/DOCUMENTS

- Assignment and Bill of Sale (PSA)
- Buyer Parent Guaranty (PSA)
- Tax Partnership Agreement (JDA)
- Buyer Parent Guaranty (JDA)
- Mortgages (JDA)
  - To be coordinated with JOA mortgage

OTHER AGREEMENTS/DOCUMENTS (CONT.)

- Memoranda (JDA)
  - To be coordinated with JOA recording supplement
- Agreed Work Program and Budget (JDA)
- Provisional Work Programs and Budgets (JDA)
- Form of Assignment, if AMI utilized (JDA)
- Secondment Agreement
- Technical Services Agreement

JOINT OPERATIONS

- Seller typically serves as operator
  - Joint Development Agreement typically has robust description of operator duties, in addition to description of duties in Joint Operating Agreement
  - Buyers increasingly seeking opportunities to operate
  - Buyer may negotiate special purpose entity as operator
- Change-in-operatorship options
  - Buyer ability to become operator
    - Drilling vs. Production
    - Property-by-property
    - Occurrence of specified milestones
    - Passage of time

JOINT OPERATIONS (CONT.)

- Operating Committee/Joint Technical Team
  - Sharing of technical information
  - Exposure to technology
  - Input
  - Control
  - Advisory vs. decision-making role
- Development and approval of annual and multi-year budgets and/or plans
  - Work Programs and Budgets
    - Operations and estimated costs
    - Planning vs. commitment
    - Agreed vs. provisional

JOINT OPERATIONS (CONT.)

- Ability to second buyer employees into seller's organization
  - Not common in US industry
  - Knowledge transfer, confidentiality and liability issues

TITLE AND LAND

- Level of title diligence carried out by Seller
- Amount of acreage held by production
  - Transactions typically characterized by significant portions of PUDs and/or other non-producing acreage
- Potentially longer title diligence period
- Potential use of replacement acreage (non-producing acreage) to address title defects
- Development plan for the contract area
- Potentially unfamiliar property concepts

DILIGENCE

- Commercial
- Title
- Encumbrances
- Material Contracts
- Field/Facilities Inspection
- Environmental Review
- Rig Availability
- Frac Crew Availability
- Water Sourcing – Rights and Infrastructure

DILIGENCE (CONT.)

- Water Disposal – Rights and Infrastructure
- Gathering/Handling/Processing, Transportation and Sales Infrastructure (and Rights)
- Access Rights
- Data Licensing Requirements
- Access to Technology
- Surface Use Rights

MODIFICATION OF AAPL MODEL FORM OPERATING AGREEMENT

- Technology and structure raise topics that should be addressed
- Many topics may be addressed by relatively minor modification of model form
  - "Completion" (Definitions)
  - "Deepen" (Definitions)
  - "Sidetrack" (Definitions)
  - "Zone" (Definitions)
  - Title Examination (Article IV.A)
  - Proposed Operations (Article VI.B.1)
  - Order of Preference of Operations (Article VI.B.6)
  - Completion of Wells; Reworking and Plugging Back (Article VI.C.)
  - Liens and Security Interests (Article VII.B.)
  - Maintenance of Uniform Interest (Article VIII.D.)

MODIFICATION OF AAPL MODEL FORM OPERATING AGREEMENT (CONT.)

- Others require additional provisions
  - Pilot Wells
    - Typical only in very early stage project
    - Define, please
    - Is participation obligatory?
  - Multi-Well Drilling Pads
    - Multiple-well proposals
    - Program election vs. well-by-well election
  - Joint Technical Team/Operating Committee
    - Exposure to technology; input; control
    - Advisory role vs. decision-making role
  - Work Programs and Budgets
    - Planning vs. commitment
    - Operations and estimated costs

MODIFICATION OF AAPL MODEL FORM OPERATING AGREEMENT (CONT.)

- Operating Agreement versus Joint Development Agreement

MISCELLANEOUS

- Areas of Mutual Interest
  - Parties share in acquisitions in the contract area
  - Maintains alignment
  - Primary acquiror
  - Buyer involvement

MISCELLANEOUS (CONT.)

- Midstream options
  - Structuring and alignment are critical to success
    - Provide take-away capacity for upstream assets
    - Represent potential separate business opportunities
  - Future midstream activities should be addressed
  - Potential forms of structure
    - Buyer acquires undivided interest in midstream infrastructure and contract rights
    - Buyer contracts to use seller's midstream assets and capacity
    - Establish jointly-owned midstream special purpose entity
- Water sourcing and water disposal options
- Unusual surface restrictions

MISCELLANEOUS (CONT.)

- Transfer restrictions
  - Consents to assign
  - Preferential rights to purchase
    - Asset sale vs. change in control
    - Exclusions based on type of sale
  - Maintenance of Uniform Interest
- Tax partnership
  - Carry requires use of tax partnership to capture full tax benefits
  - Treats interests as being in partnership for US federal tax purposes only
  - Eliminates issue of income recognition in relation to acreage earned outside a drill site

MISCELLANEOUS (CONT.)

- Non-US investors
  - Motivation
    - Project economics
    - Access to technology
    - Personnel development
  - Committee on Foreign Investment in the United States (“CFIUS”)
  - Qualification to hold federal or state leases
  - Potential technology transfer restrictions
  - Disclosure requirements
  - Unfamiliar tax concepts
  - Unfamiliar property concepts

ALTERNATIVE APPROACHES TO ACQUIRING RESERVES

- Standard Purchase and Sale Agreement
  - Outright purchase of reserves
  - No joint development
- Volumetric Production Payment
  - Future delivery
  - Specified volumes during specified periods

THE JAPANESE CASE FOR SHALE GAS

- Gas Pricing Differential
- Recent Japanese Investment in US Oil and Gas Projects
- Japanese Involvement in North American LNG Liquefaction Plants
- Overview of US Gas Market
- Conclusion

GAS PRICING DIFFERENTIAL

- US vs. Japan Natural Gas Pricing
  - North American prices generally are linked to "**Henry Hub**", a gas pipeline hub located in Louisiana
  - The Henry Hub price is driven by US supply and demand – there is no direct link to a crude oil index (unlike Asian markets)
  - Japan LNG import price has generally been linked to **Japan Crude Cocktail (JCC)**, the average CIF price of customs-cleared crude oil imports into Japan
  - The current differential between the Henry Hub price and the average Asian LNG import price is unprecedented – spread of approx. $12-$14/MMBtu:
    - Henry Hub – around $4/MMBtu ($1.88 on April 2, 2012; $4.08 on March 29, 2013); and
    - JCC-linked price has been around $16-18/MMBtu

GAS PRICING DIFFERENTIAL (CONT.)

Decline in Henry Hub Spot Prices Last 5 Years (USD/MMBtu)

GAS PRICING DIFFERENTIAL (CONT.)

Comparison of Henry Hub Price to JCC

Henry Hub price

UK NBP

Japan Crude Cocktail (JCC)

GAS PRICING DIFFERENTIAL (CONT.)

- Gas Pricing Differential – JCC vs. Henry Hub
  - The large difference between gas pricing in the US market and the Japanese market create an opportunity for US LNG exports to Japan
  - With liquefaction and shipping costs included, the landed price of US LNG in Japan has been estimated to be $6 - $10/MMBtu below the JCC landed price, assuming the current differential between Henry Hub and JCC prices remains, which is a big assumption

RECENT JAPANESE INVESTMENT IN US OIL AND GAS PROJECTS

Announced	Japanese Party	Project Location	Lead Developer	Notes
04/01/2013	Tokyo Gas Co.	Barnett Shale, TX	PG Barnett Resources	25%
06/22/2012	Osaka Gas Co Ltd.	Pearsall Shale, TX	Cabon Oil & Gas Corp-Pearsall	35%
08/01/2012	Sumitomo Corp.	Cline Shale, TX	Devon Energy Corp-Shales	30%
01/06/2012	Marubeni	Eagle Ford, TX	Hunt Oil	35%
06/30/2011	Mitsui Group	Eagle Ford, TX	SM Energy	12.5% Oil & Gas
06/20/2011	JGC	Eagle Ford, TX	TriTech I	10% In production
04/06/2011	Marubeni	Niobrara, WY	Marathon Oil	30%
10/15/2010	Itochu	Niobrara, WY	Fidelity	25%
09/01/2010	Sumitomo Corp	Marcellus, PA	Rex Energy	30%
02/16/2010	Mitsui and Co., Ltd.	Marcellus, PA	Anadarko	15.5%

JAPANESE INVOLVEMENT IN NORTH AMERICAN LNG LIQUEFACTION PLANTS

- Mitsubishi and Mitsui agreed with Sempra Energy to jointly develop a U.S. liquefaction export facility at the site of Cameron LNG receipt terminal in Louisiana, with the aim to reach final investment decision by late 2013 and to export the produced LNG to Japan by late 2016. Mitsubishi and Mitsui will enter into tolling agreements for 4 mtpa of LNG each
- Sumitomo Corp and Tokyo Gas Co Ltd have agreed with Dominion Resources Inc. for a 20-year tolling arrangement to export up to 2.3 mtpa of LNG starting in 2017 from Dominion's Cove Point Terminal in Maryland
- Mitsubishi Corp., together with Korea Gas Corp., PetroChina Co. and Royal Dutch Shell PLC, agreed to develop the LNG Canada project, a gas liquefaction export facility projected to ship 12 mtpa of LNG, targeting to start operation by the end of 2010's

JAPANESE INVOLVEMENT IN NORTH AMERICAN LNG LIQUEFACTION PLANTS (CONT.)

- Toshiba Corporation, Osaka Gas Co. Ltd. and Chobu Electric Power Co. have each entered into 20-year tolling arrangements with Freeport LNG Expansion LP for 2.2 mtpa of LNG from Freeport's facility near Freeport, Texas

OVERVIEW OF US GAS MARKET

- Dramatic Change from Import to Export
  - Regulation of US gas prices led to artificial shortages of domestic gas in the late 1970s
  - Price controls on gas sales were phased out starting in 1978
  - Free market in gas led to improved gas supplies and fluctuating gas prices
  - U.S. gas market de-linked from world oil market
  - As conventional sources of U.S. gas production were depleted, prices began to rise; LNG imports became an attractive option
  - Recent development of shale/unconventional gas sources dramatically changed the U.S. market
    - Gas supplies are up
    - Prices are near their lowest level since deregulation
    - Export of LNG is under serious consideration

OVERVIEW OF US GAS MARKET (CONT.)

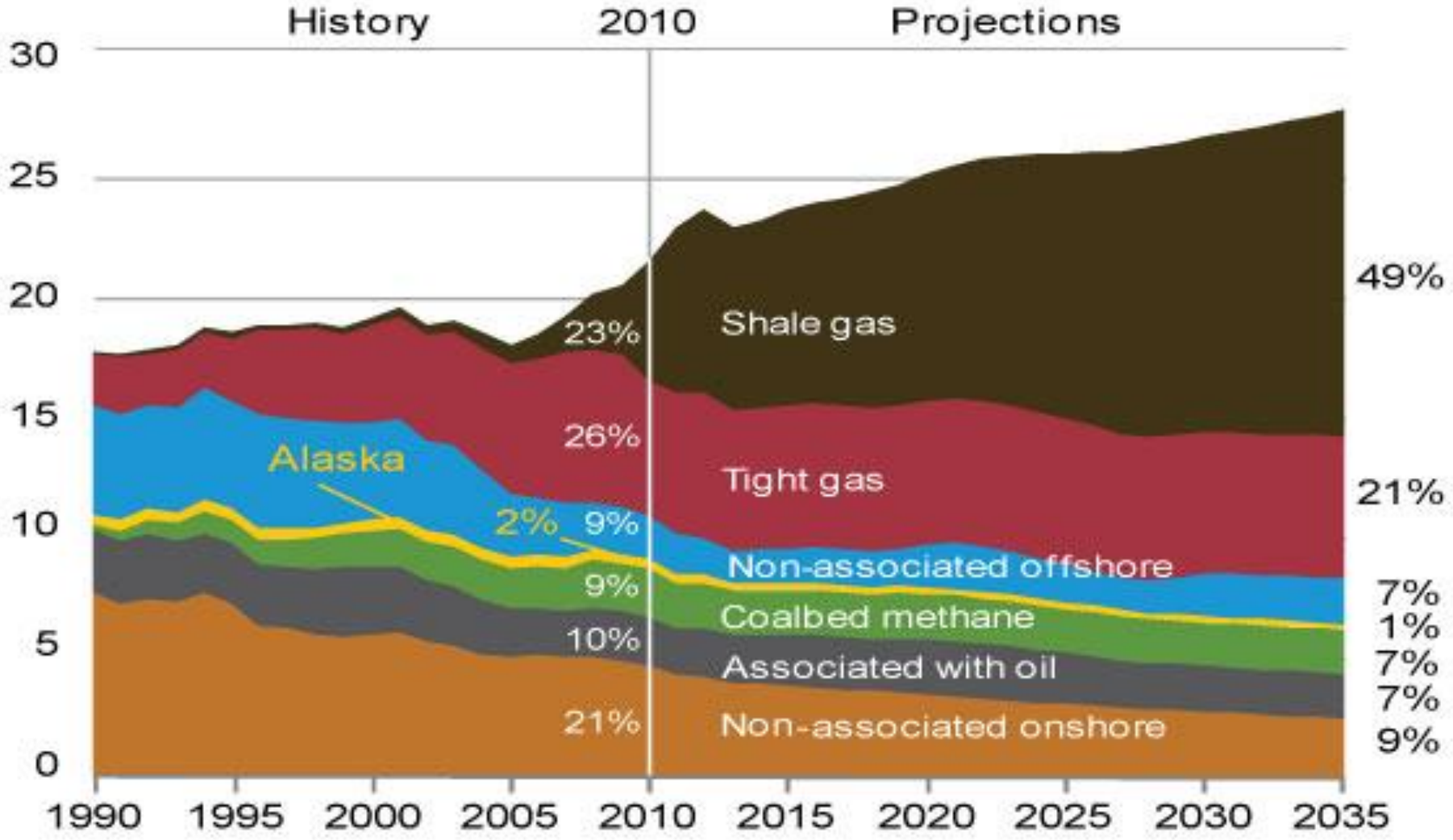
- Unconventional Resource Development
  - The US is unique among major sources of export LNG – most of its gas production comes from “unconventional” shale plays
  - “Conventional” wells are vertical wells drilled into and producing from formations that have historically served as reservoir rock
  - “Unconventional” wells are drilled into and produce from formations that have historically served as source rock or seal (as opposed to reservoir rock) and utilize a combination of two long-standing, but greatly-improved, technologies: horizontal drilling and multi-stage hydraulic fracturing

OVERVIEW OF US GAS MARKET (CONT.)

- Hydraulic Fracturing
  - In order to open spaces in the rock, large volumes of water (mixed with sand and small percentages of other application-specific chemicals, normally less than 2% by volume) are injected at high pressures into the well
  - The high-pressure fluid causes fractures along the horizontal wellbore in the producing formation, allowing gas to flow
  - The sand in the fluid serves as the “proppant,” which keeps the fractures open for gas flow

U.S. Natural Gas Production, 1990-2035

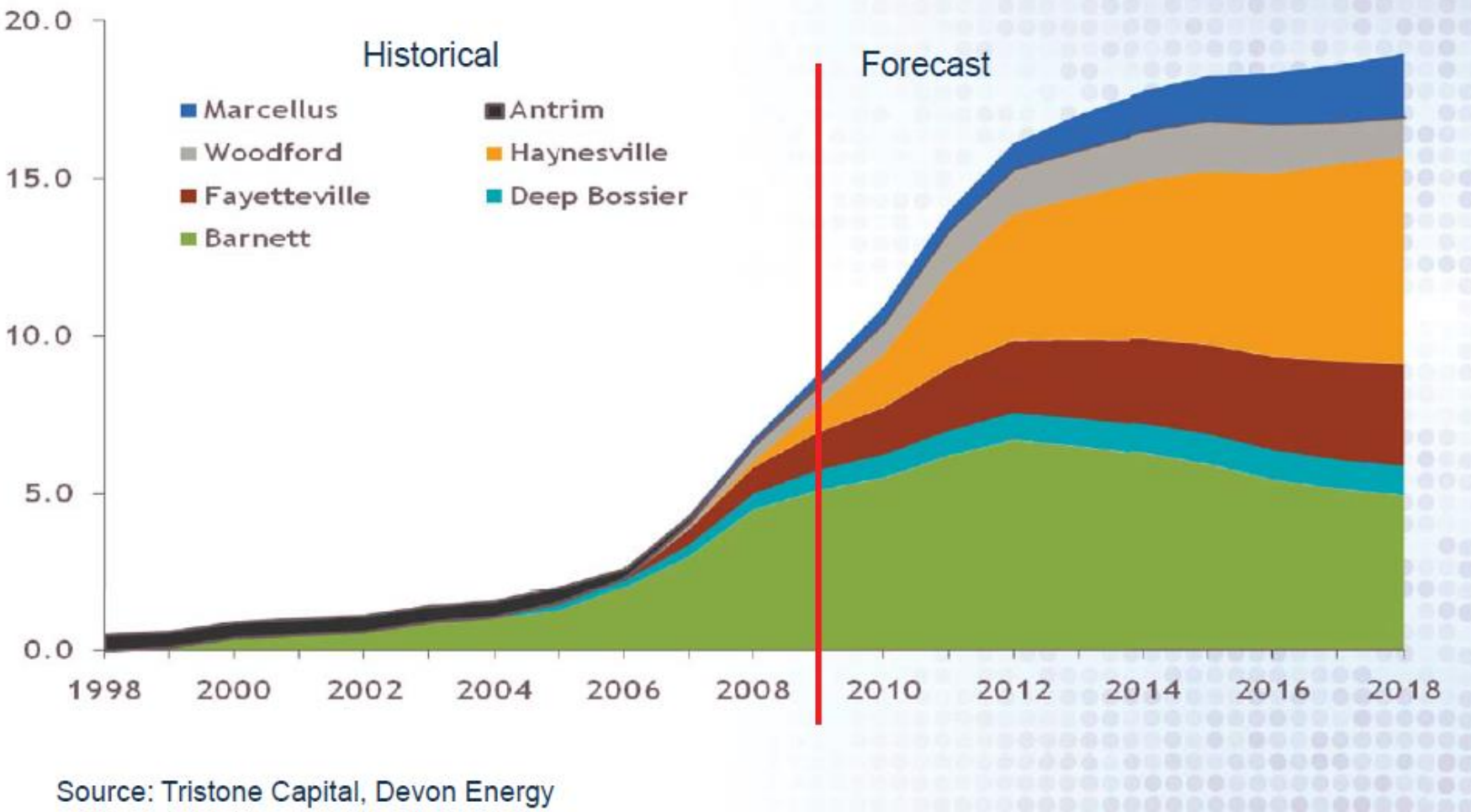
trillion cubic feet



Source: U.S. Energy Information Administration, AEO2012 Early Release Overview, January 23, 2012.

OVERVIEW OF US GAS MARKET (CONT.)

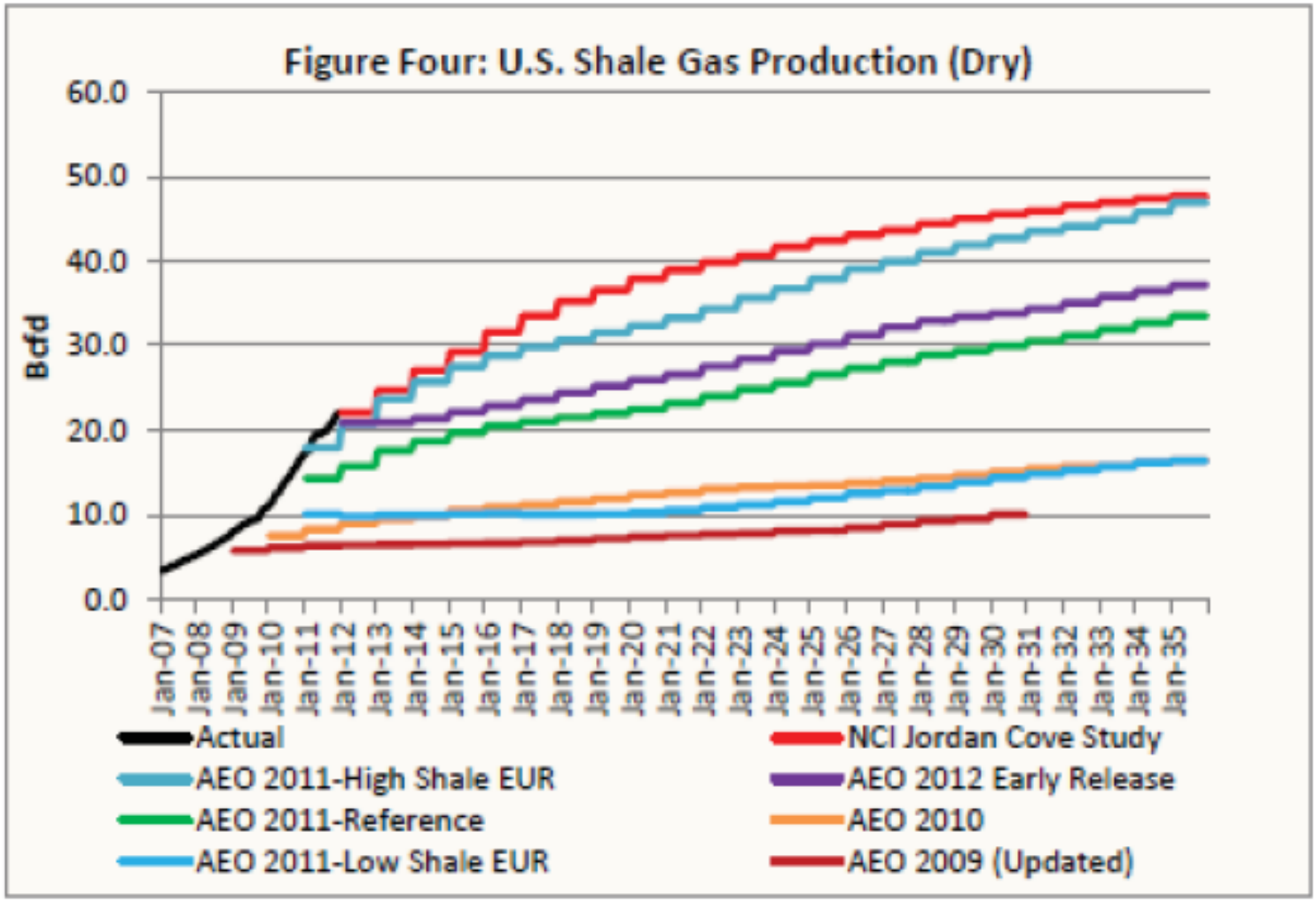
U.S. Shale – A Game Changer? Gas Production Potential



Source: Tristone Capital, Devon Energy

OVERVIEW OF US GAS MARKET (CONT.)

Dramatic Increases in Shale Gas Production Estimates



Source: EIA; Lippman/Navigant

OVERVIEW OF US GAS MARKET (CONT.)

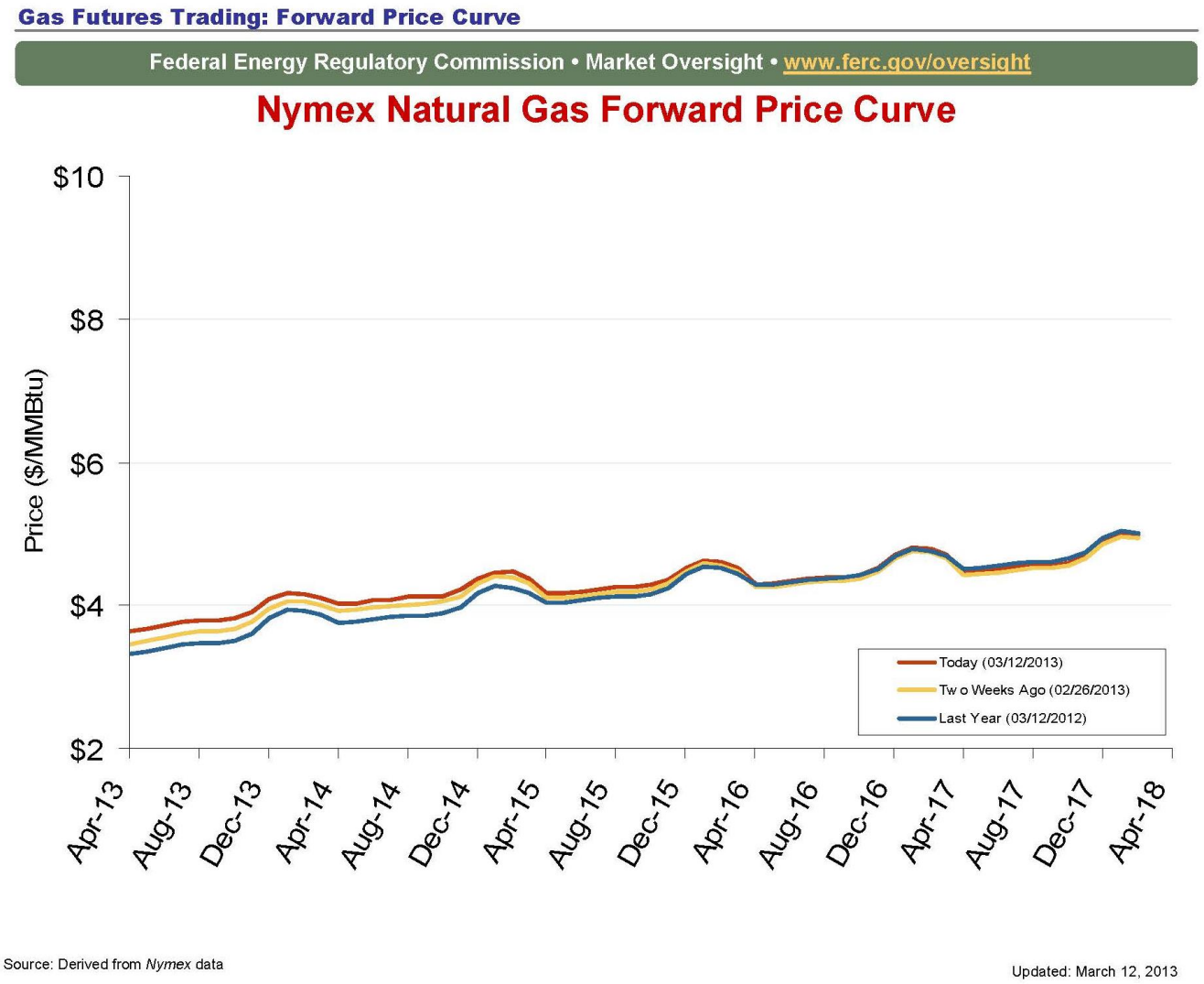
- Upstream Investment Considerations
  - "Dry" gas: does not contain liquid hydrocarbons that require processing
  - "Wet" gas: contains entrained natural gas liquids (NGLs) (*e.g.,* butane, ethane, propane), and requires processing to reach pipeline quality
  - NGLs have a market value that typically exceed current dry gas market value
  - As a result, "wet" gas (and oil) shale plays (*e.g.,* Eagle Ford or Bakken, respectively) are more valuable than "dry gas" plays (*e.g.,* Barnett or Haynesville)

OVERVIEW OF US GAS MARKET (CONT.)

- Upstream Investment Considerations (cont.)
  - Some operators have shut-in dry gas wells due to low market prices, while “wet” gas production is much less affected
  - Low market prices put pressure on companies holding only dry gas reserves, depressing asset prices, and creating potential opportunities for investment
  - This is reflected in M&A activity in the upstream sector

OVERVIEW OF US GAS MARKET (CONT.)

US Forward Gas Prices (circa April 18)

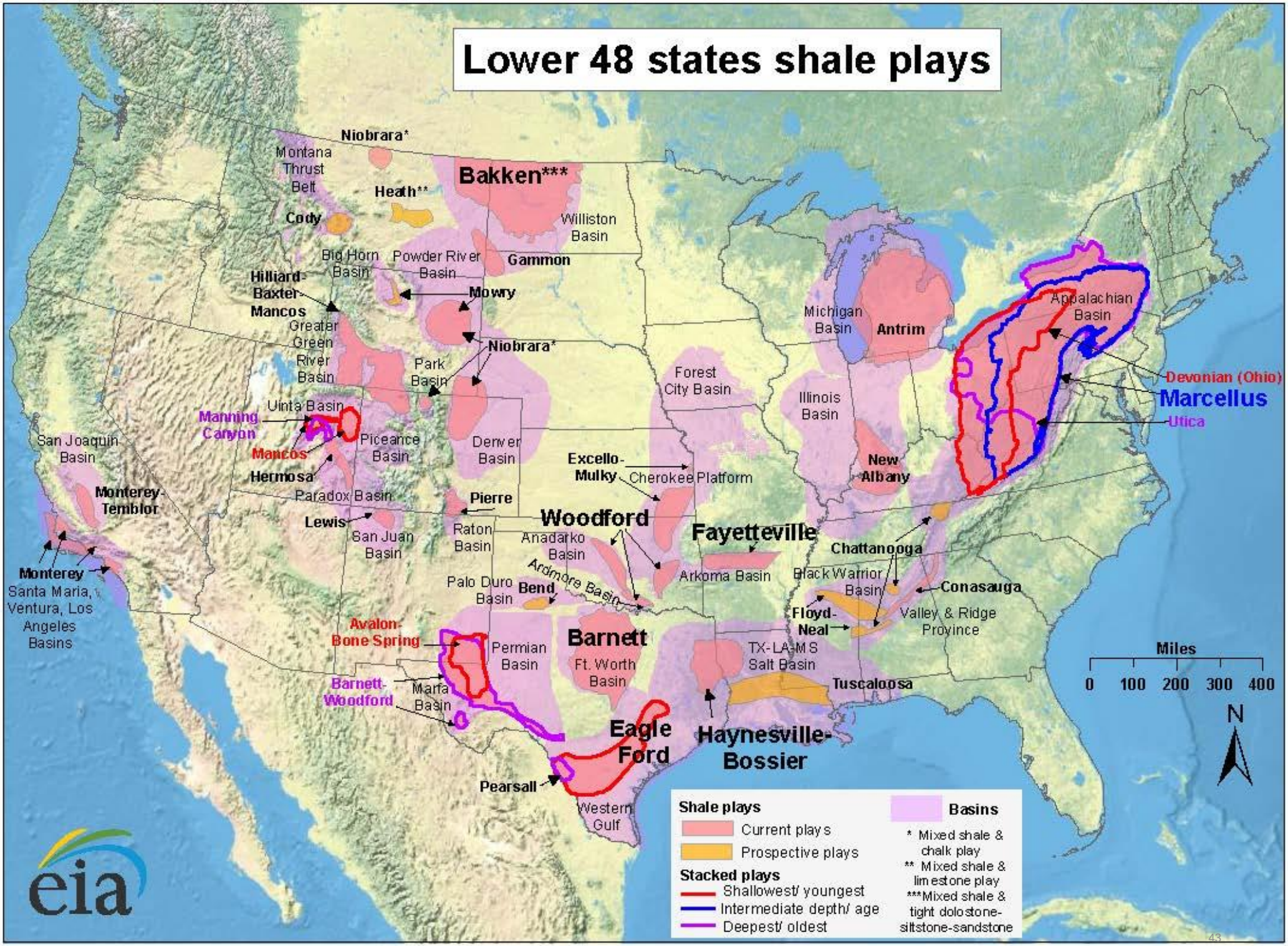


Source: Derived from *Nymex* data

Updated: March 12, 2013

CONCLUSION

- Supply Projection Volatility = Opportunity
  - Unconventional wells have different decline curves than conventional wells, creating uncertainty around proper models
    - large-scale unconventional production has been employed for only 5 years in most US fields, resulting in limited data
  - This results in differing estimates of total US long-term reserves
  - US forward prices are responding in part to the perception that there may be very large aggregate reserves although those estimates may not prove as high as initially expected
  - Volatility and uncertainty in supply assessments lead to investment opportunities



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