The Really Big Game Changer: Crude Oil Production from Shale Resources and the Tuscaloosa Marine Shale

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New natural gas supply availability is having considerable impacts on all energy markets today and on longer term, forward-looking basis.

Shale revolution is now migrating into liquids and crude oil production. Facilitating additional natural gas production despite low prices.

Considerable economic development opportunities.

Early in the process, considerable uncertainties, considerable risks, difficult to attain information, play understandings still very preliminary – policy need to manage expectations despite the (justified) excitement.
Reminder – The Way Things Were
Relatively uninspiring U.S. crude oil production forecast.

Source: USDOE/EIA, Annual Energy Outlook, 2006
Natural gas production forecasted to decrease starting in 2016.

Source: USDOE/EIA, Annual Energy Outlook, 2006
Prices reflected the state of, and outlook for, energy markets.

First energy price crisis

Recession

Source: Federal Reserve Bank
The maturing nature of US basins reflected in drilling productivity.

- **3 percent increase in production** (Aug-99 to Sep-01)
- **158 percent increase in rigs** (Apr-99 to Jul-01)
- **131 percent increase in rigs** (Apr-02 to Aug-06)
- **4 percent decrease in production** (Feb-04 to Aug-06)

Source: Energy Information Administration, Department of Energy; and Baker-Hughes Inc.
Policy advocacy focused on restricted areas as a potential solution to the resource constraint problem.

LNG provides 14% of the U.S. supply of natural gas by 2025.

* Includes lower-48 production, ethane rejection, and supplemental gas.
What Changed? The Way Things Are
Unconventional vs. Conventional Geological Formations

Schematic geology of natural gas resources

Conventional non-associated gas

Land surface

Coalbed methane

Conventional associated gas

Seal

Oil

Sandstone

Gas-rich shale

Tight sand gas
Shale, Horizontal Drilling, and Fractionation

- Shale (unconventional) wells differ from “conventional” wells since they are drilled horizontally and not vertically.

- Horizontal segments are then “fractured” with higher pressure water, chemicals and silica to break up the formation.

- The fractionation process releases/liberates the hydrocarbons.

- Some environmental and water use concerns expressed in some areas of the country on this drilling process.

Source: Energy Tomorrow
Recent Trends

Production from a Typical Well and Shale Well

Illustrative production decline from a convention vs. shale producing well. As much as 80 percent of total production thought to occur in the first two to three years.
Unlike conventional resources, shale plays (natural gas, liquids, and crudes) are located almost ubiquitously throughout the U.S. and are the primary reason for the decrease in overall and regional natural gas prices.
The 2001 to 2009 market trend of higher average prices coupled with high volatility is reversing itself and post 2009 prices are significantly lower.

Average 1997 through 2000: $2.79 (standard deviation: $1.28)


Since 2009: $4.11 (standard deviation: $0.70)

Current U.S. natural gas reserves are approaching record levels not seen since 1970. Natural gas production is at levels that surpass historic peaks.

Source: Energy Information Administration, U.S. Department of Energy
Natural gas imports, once thought to be the supply remedy for meeting future gas needs, are falling to levels also not seen since the 1990s.

Source: Energy Information Administration, U.S. Department of Energy
Unconventional resources are not a “flash in the pan” and are anticipated to continue to increase over the next two decades or more.

Source: Energy Information Administration, U.S. Department of Energy
Close to 6,000 TCF of shale gas opportunities around the world. Coupled with 9,000 Tcf in conventional suggest a potentially solid resource base for many decades.
Shale availability will drive U.S. natural gas supply.

- Shale gas
- Tight gas
- Alaska
- Non-associated onshore
- Non-associated offshore
- Coalbed methane
- Associated with oil
Choosing Most Current Natural Gas Price Forecasts: AEO-2007 to AEO-2012

Shale availability has significant impact on future price outlook.

Source: Energy Information Administration, U.S. Department of Energy
Game Changer 2: Crude and Liquids
Two significant breaks (decoupling) of natural gas and crude oil prices.

First price decoupling: Gas Up, Crude Down

Second price decoupling: Crude Up, Gas Down

Source: Federal Reserve Bank
Onshore rig counts are moving close to their pre-recession levels, primarily motivated by increased crude oil drilling, not natural gas.

Source: Baker Hughes.
For the first time in 16 years, the number of oil rigs is equivalent to gas rigs.

Source: Baker Hughes.
Drilling rig activity increasing rapidly in liquids rich shale.

Source: Baker Hughes; and Federal Reserve Bank of St. Louis.
Indexing the rig change from January 2009 highlights the basin preference.

Haynesville is losing its competitive advantage due to the liquids preference associated with other shales.

Source: Baker Hughes. Rig counts are indexed to the level of active drilling rigs in each reported area as of January 2009.
Crude Awakening | Fracking has helped ignite a rise in U.S. oil production

U.S. shale deposits
- Current
- Prospective

Bakken shale
Niobrara shale
Monterey shale
Barnett shale
Eagle Ford shale

U.S. oil-production forecast
- Gulf of Mexico
- Alaska
- Other onshore oil
- CO2-enhanced oil recovery
- Oil from fracking
  - 7 million barrels a day

Light crude oil supplies from U.S. shale fields, in thousands of barrels a day

- Bakken Shale: 800
- Niobrara Shale: 800
- Eagle Ford Shale: 800
- Barnett Shale: 800
- Monterey Shale: 800

Sources: U.S. Energy Information Administration; International Energy Agency (individual shale production)

The Wall Street Journal
Liquids production from shale plays > 3 million barrels per day by 2020
Associated natural gas > 7 Bcf/d of “costless” supply (or about 2.3 Bcf/d per every 1.0 MMBbls/d of shale-based liquids production).

Includes Eagle Ford, W. Barnett, Bakken Shales; Granite Wash, Piceance & Uinta Tight Sands

Source: Advanced Resource Intl; presentation to Cheniere Board, March 2011; Cheniere Research
Center for Energy Studies

Closer to Home: Louisiana and the Tuscaloosa Marine Shale ("TMS")
Crude Oil Shale Opportunities -- Louisiana

- 1998 LGS Study primary publicly-available source of information on the formation.
- Lies between sands of the upper and lower Tuscaloosa.
- Approximately 2.7 MM acres.
- Varies in thickness from 500 feet (MS) to around 800 feet (LA).
- Shallowest opportunity around 10,000 feet – mostly between 11,000 to 12,000 – some areas as deep as 16,000 (EBR).
- Estimated potential resource of 7 BBbls.

Source: Oil and Gas Journal and Louisiana Geological Survey.
Approximately 13 wells drilled to date.

Source: Amelia Resources.
• Recently-drilled wells located primarily in southwestern MS and in the Florida parishes.
Source: Amelia Resources.
Tuscaloosa Trend Scout Report, Score Card

Source: Amelia Resources.
Initial production ("IP") rates important, but only one of several statistics that should be reviewed given typical production characteristics and uncertainty.

Source: Amelia Resources.
The Early Days, Eagle Ford Shale

Source: Amelia Resources.
Oil and gas employment is almost 40 percent above its 2005 level while total U.S. employment struggles to regain four years of losses.

Source: Bureau of Labor Statistics
A comparison of total employment tells story beyond just oil and gas. Recession not as severe; recovery more robust.
Conclusions
• Exceptional industry performance: employment up; reserves up; production up; investment/capacity up; and exports up.

• Traditional sectors of energy industry have proven they are high technology, high capital, and high growth – you’d have a hard time figuring that out watching the nightly news.

• Policy and perception continue to be things that plague continued industry development. It is hard to imagine the development and innovation that could arise if the current policy uncertainty were removed.

• Policy uncertainty is the biggest impediment to continued development. Significant short-term policy retrenchment on unconventional resources could lead to economic impacts that would pale in comparison to past financial and housing crisis.