The Resource Triangle

Conventional Reservoirs
Small volumes that are easy to develop

Unconventional Reservoirs
Large volumes difficult to develop

High-Medium Quality
- Low Perm Oil
- Gas Shales
- Gas Hydrates
- Coalbed Methane

Tight Gas Sands
- Heavy Oil

Oil Shale

Increased pricing
Improved technology

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Marcellus Geology

- Areal extent: 34 million acres (53,125 sq. mi.)
- Depth: 4,000 to 8,500 feet
- Thickness: 50 to 250 feet
- Total Organic Carbon: 2% to 10%
- Kerogen: Type II to Type III
Producing Marcellus Wells

Red: Marcellus wells

Black: Marcellus commingled with other zones.

Source: EIA
As of July 2011
The Marcellus shale is naturally fractured throughout the Appalachian Basin.

It carries two vertical joint sets, and hydraulic fracturing works well to exploit these joint sets.

It carries both organic and inorganic porosity.

Pressure regimes vary from high to transitional to low.

The play’s west side has high-BTU gas.
Marcellus Pore Types

- Matrix Intergranular
- Kerogen Intraparticle

Organic porosity is developed within diagenetically altered kerogen.

Source: Dr. John Ward: Marcellus Porosity Regional Viewpoint, DUG East
Marcellus Shale Valuation:
- High
- Low
Recoverable Resources

- OGIP: 20 to 150 Bcf/sq. mile.

- U.S.G.S. recently assessed mean undiscovered natural gas resource of 84 Tcf and mean NGL resource of 3,379 million barrels. That equates to 102.5 Tcfe. Last estimate of proved reserves in 2009 was 4.5 Tcfe, for a total of 107 Tcfe.

- Hart Energy’s North American Shale Quarterly service estimates 130 Tcfe of economically viable resources.
Marcellus Well Specifics

- Well Cost: $3.5- to $6.5 million.
- Laterals: ~ 3,500 to 4,500 ft.
- Average well design: 10-12 frac stages, pumping 400,000 gallons of water and 400,000 lbs of sand per stage.
- Total per-well requirements: 115,000 barrels of water and 2,400 tons of sand.
Marcellus Economics

• Average well makes 4.7 Mmcfe per day for its first 30 days; average EUR is 5.2 Bcfe.

• $5-million per-well cost.

• NPV = $3.83 million per-well average.

• Average breakeven costs for the Marcellus for the top operators is $3.85 per Mcf.
Rig Count By Area
Pennsylvania Activity

Non Marcellus Shale Wells  Marcellus Shale Wells
2011 1H Wells Drilled, Pennsylvania

Department of Environmental Protection
Bureau of Oil and Gas Management
Wells Drilled

2011 January-June Wells Drilled - 1,135
Non Marcellus Shale - 327
Marcellus Shale - 808

As Reported by Operators

Updated 07/11/2011
Marcellus Top Operators, Pennsylvania

Top 5 Operators Represent 54% of Rig Count

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Smith International, Hart Energy
West Virginia Activity

- The new-generation Marcellus play covers ~3 million acres in northern WVa.
- The Marcellus is thinner and has less pressure in WVa, as compared to Pa.
- About 30 rigs are active in WVa.
- Most active operators in WVa are Chesapeake and Antero.
Company Acreage By State, 000s of Acres

- Chesapeake
- Range Resources
- National Fuel Gas
- Talisman Energy
- Chevron
- Consol Energy
- Statoil
- Shell
- EQT Corporation
- Anadarko
- Cabot Oil and Gas

- Pennsylvania
- West Virginia
- Ohio/New York

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Additional Positions

These companies hold an additional 3.1 million acres:

Carrizo, Williams, Southwestern, ExxonMobil, EOG, Antero, Triana, Rex, Stone, Endeavour, Unit, Statoil, EVEnergy/Enervest, Reliance, Ultra, EXCO
Marcellus Resources by Company

- Chesapeake
- Range Resources
- Statoil
- Cabot Oil and Gas
- Talisman Energy
- EQT Corporation
- Consol Energy
- Chevron
- Shell
- National Fuel Gas
- Anadarko

Estimated Ultimate Recovery: 48.8 Tcfe
Recent Marcellus Transactions

$21 Billion Since Jan. 1, 2010

Largest deals:
Mitsui/Anadarko, $1.4 Billion
Consol/Dominion, $3.5 Billion
Reliance/Atlas, $1.7 Billion
Shell/East, $4.7 Billion
Chevron/Atlas, $4.3 Billion
ExxonMobil/Phillips, $1.7 Billion
The Marcellus Narrative

• The JV-Era of Finance:
  Chesapeake/Statoil; Atlas/Reliance; EXCO/BG; Anadarko/Mitsui

• The Majors Move In:
  Shell, Chevron, ExxonMobil
  While everyone else gets oilier, majors go for Marcellus gas!

• Play Is Becoming Concentrated.
Marcellus Outlook

- Chevron, ExxonMobil and Shell are still early in their ramp phases.
- Another 20 rigs could be added by 2012.
- Regulatory and public relations issues could constrain activity, but will not stop it.

It’s only just begun!
Traditional Flow of Natural Gas, Circa 2008

Source: adapted from NiSource; EIA
For more information, please contact Peggy Williams at 303-756-6824 or pwilliams@hartenergy.com

Thank You!