The Mechanics of Drilling, Completions, and Production from Unconventional Natural Gas Formations

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PBA Section Day, Shale Gas Law Committee

November 19, 2015

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Introduction

- Geology
- Shale vs. Conventional Development
- Development Overview
- Recap: Drilling Animation
- Discussion

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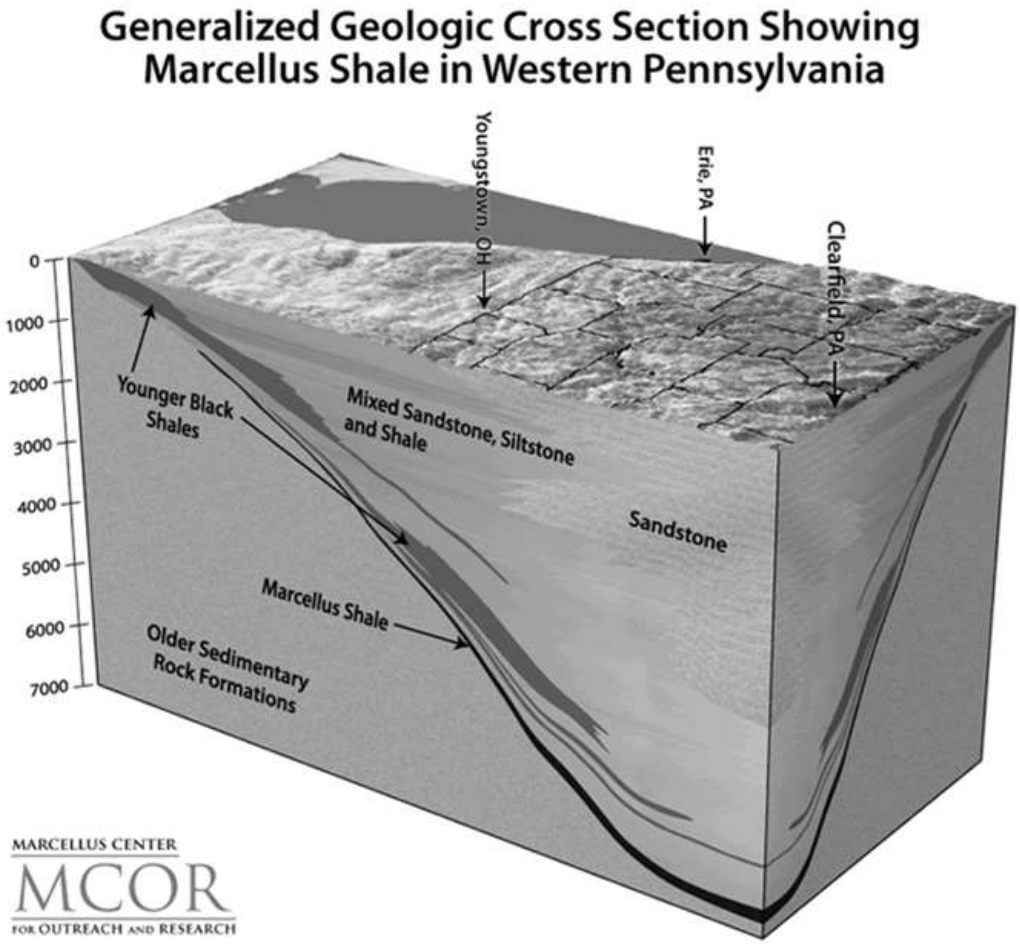
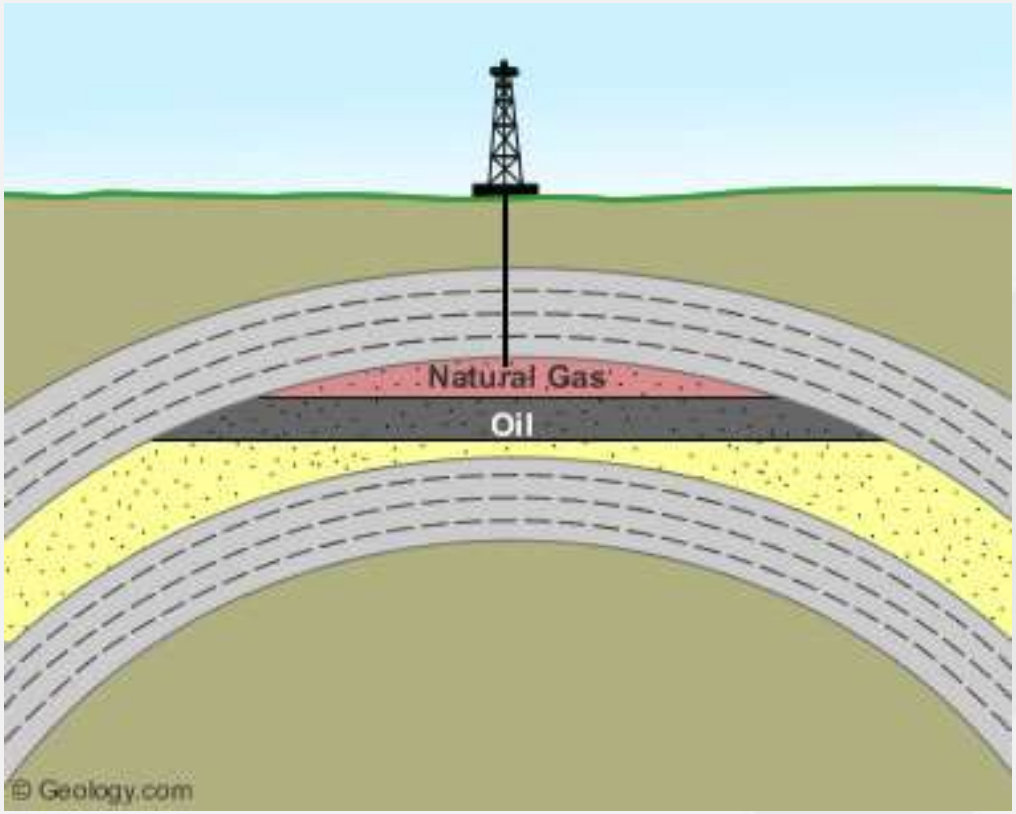
Geology



- Source Rocks
- Reservoir Rocks
- Search for Accumulation of Hydrocarbons
- Dry Gas, Wet Gas

Shale vs. Conventional



- Conventional Development: Vertical wells targeting oil or gas trapped in reservoir rocks
- Usually sandstone and limestone

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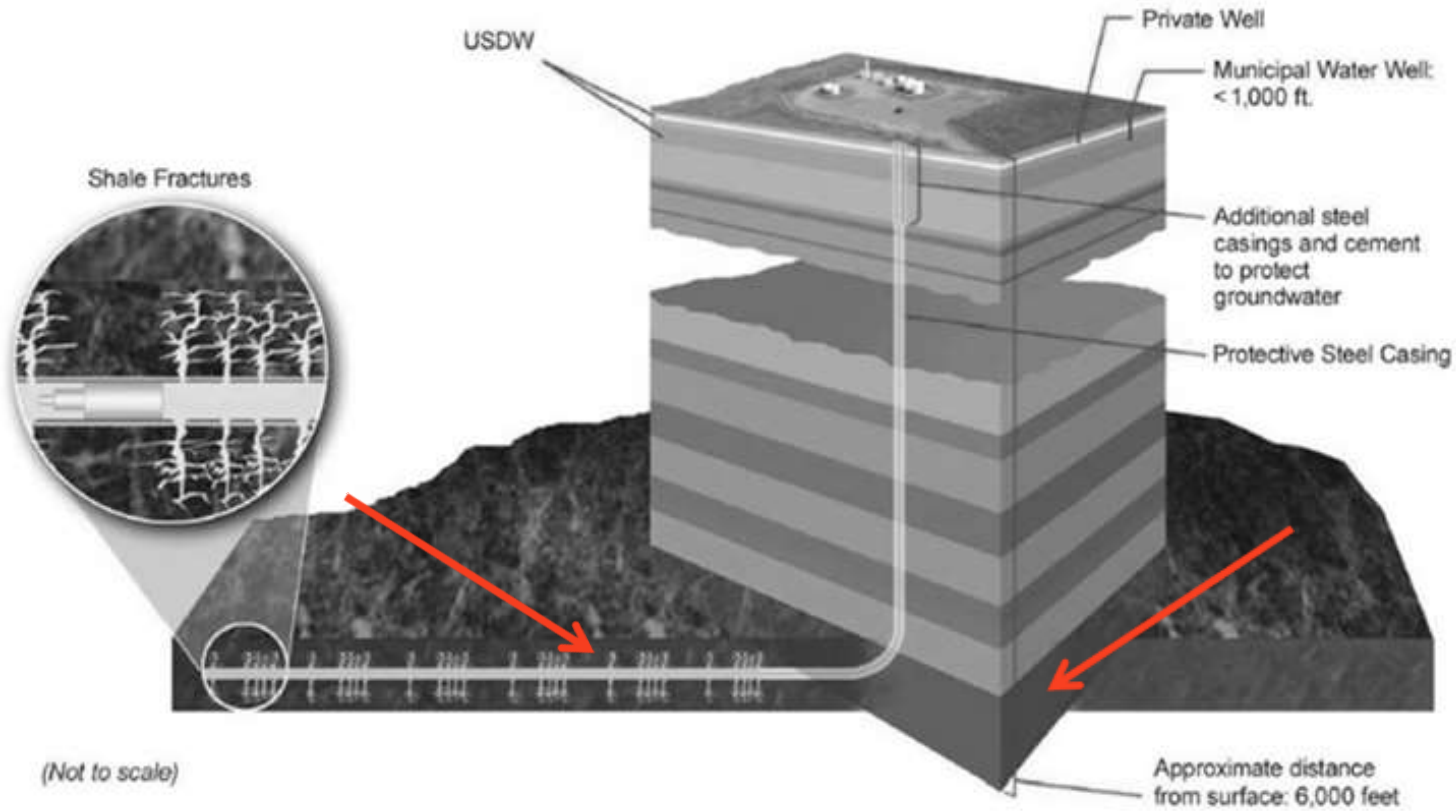
Shale vs. Conventional (cont.)



- Unconventional Development
- Targets the deeper source rock itself rather than more shallow reservoir rocks

Development Overview

From this…

To this…

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Summary

- Planning
- Well-Pad Construction
- Drilling, Casing and Cementing
- Completions (Hydraulic Fracturing)
- Production
- Transportation & Marketing

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Planning

- Prospects in Geographic Area
- Lease Acquisitions in the Prospects
- Pooling of Leases and Declaration of Pooling
- Title Opinions on Leases
- Geological Inquiry (Seismic)
- Drilling Units
- Drilling Schedule

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Well-Pad Construction

- Well pads typically 5-10 acres
- Enough to support larger scale operations

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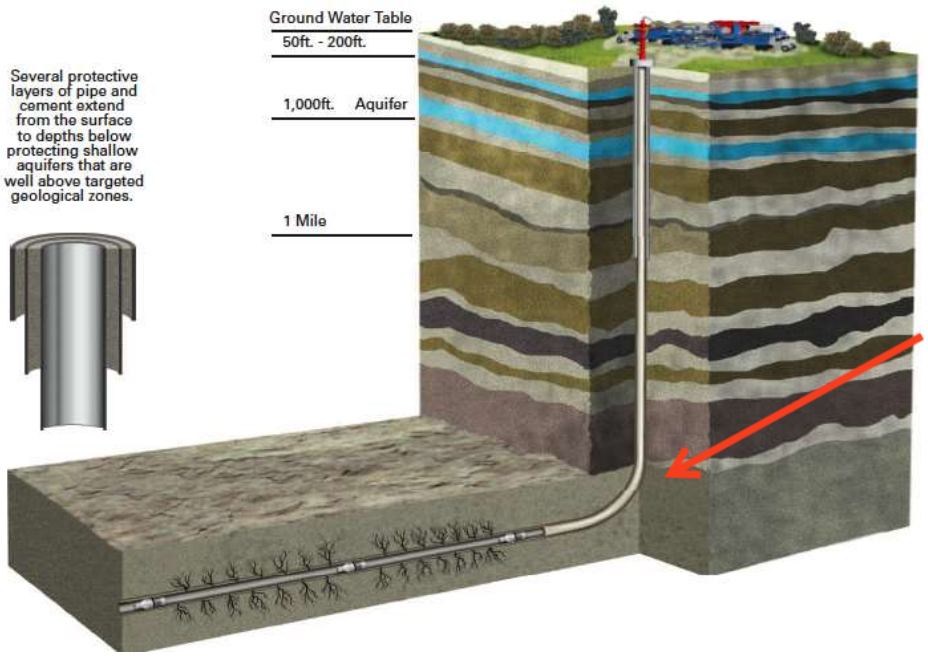
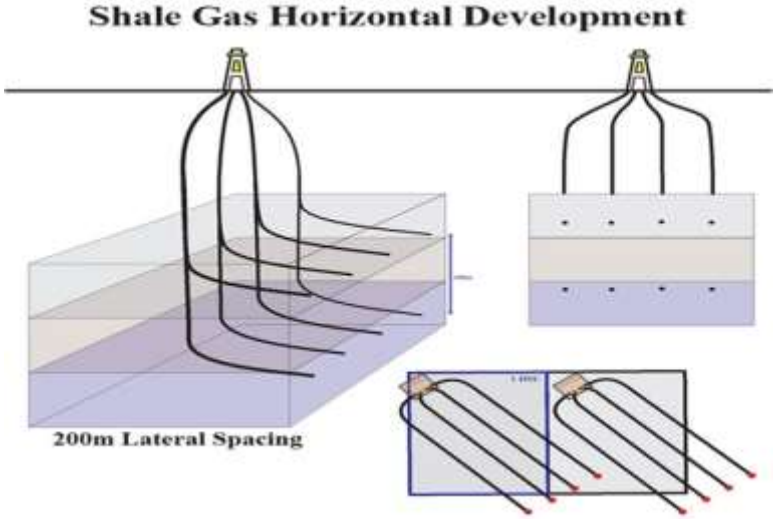
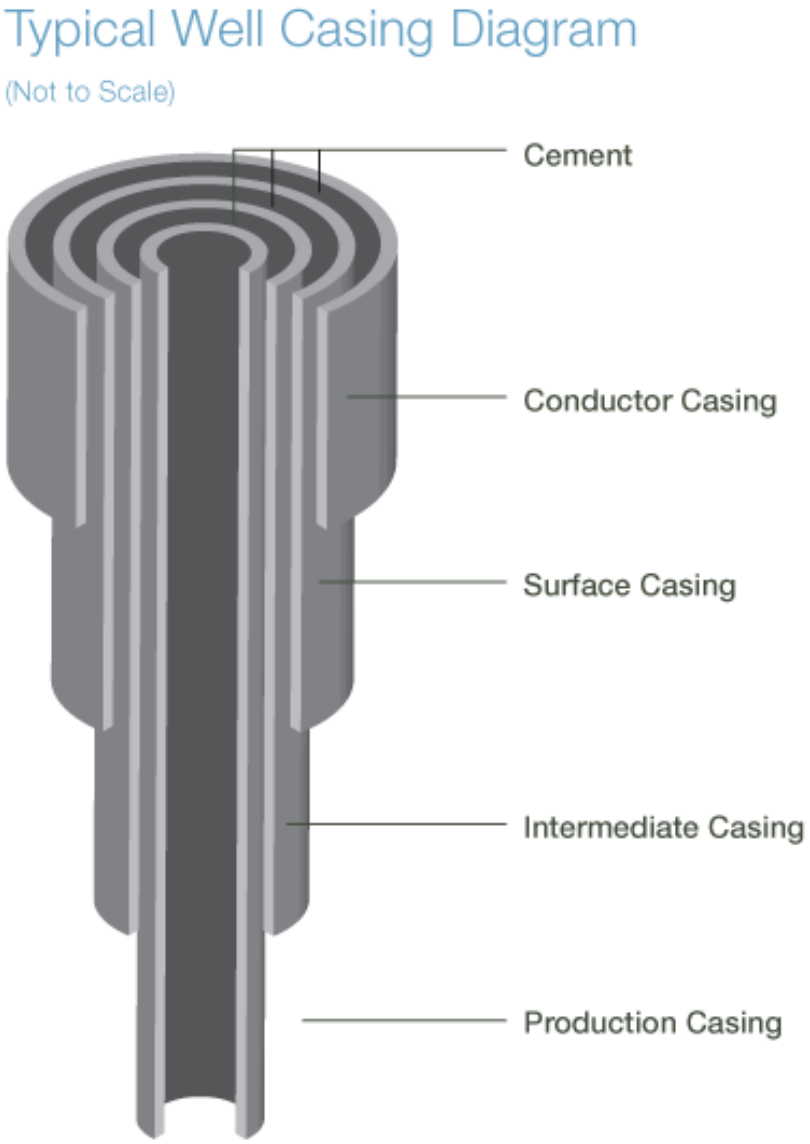
Horizontal Drilling





- Vertical well to the kickoff point
- Casing and cementing
- After vertical well reaches just above the target, the well turns gradually
- More casing and cementing
- Covers a greater area and production zone than conventional drilling

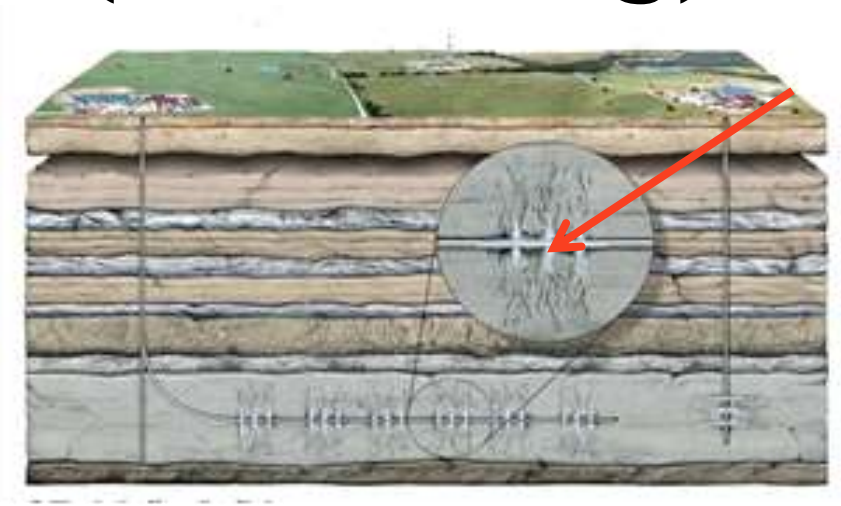
Casing and Cementing



- Set conductor pipe and cement in place
- Surface casing (protect fresh groundwater zones) and cement in place
- Intermediate casing and cement in place
- Production casing (production zones)
- Perforations for fracturing activities

Completions (Fracturing)

- Hydraulic Fracturing: Water, chemicals and propping agents injected down the well at very high pressure



- Causes the rock to crack and release natural gas
- Microseismic evaluation to measure production

Production and Transportation

Once the well produces oil and gas, the well is connected to gathering lines that transport gas to interconnections with interstate pipelines that transport gas to market.

Recap

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Discussion

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