

**The Significance of Geology
With Respect to Resource
Plays and Horizontal
Drilling/Hydraulic Fracturing
Techniques**

If it's a resource play is one well location as good as another?

Haynesville Shale (dry gas play)

- Play located in NW Louisiana & NE Texas
- Initial leasing was in Shreveport area
- Increasing depths, temperatures and pressures south= shorter lateral lengths and increased well costs
- EUR north wells +/- 3 BCF
- EUR south wells +/- 10 BCF (Encana cross unit lateral)

Tuscaloosa Marine Shale (gas-condensate?, oil play)

- Play extends across central Louisiana MS-TX
- Initial leasing central portion Florida Parishes to test the existence of a gas-condensate window

If it's a resource play is one well location as good as another?

- Decreasing depths, temperatures and pressures north=oil window
- Devon-Beach Grove 68H-1 E. Feliciana Ph. LA, IP 120 BOPD, 100 MCF/D, 30/64" CK; 950 psig
- Encana-Anderson 17H-1 Amite County, MS, IP=975 BOPD, 425 MCF/D, 15/64" CK; 2,119 psig
- Northern Avoyelles Ph. unitization

Lower Smackover Brown Dense Formation (gas-condensate, oil play)

- Deposited from Mexico to Florida panhandle extending offshore into the GOM basin
- Louisiana activity Union & Claiborne Ph
- Southwestern-Garrett 7-23-5H-1, Claiborne Ph, LA IP=301 BOPD, 1700 MCF/D

What tools should I use to design my lateral and completion procedure?

Well logs

- Gamma ray-lithology, organic rich shales
- Density-porosity, hydrocarbon response, seismic tie
- Neutron-porosity, hydrocarbon type
- Sonic-porosity, seismic tie
- Micro log-existence of permeability

What tools should I use to design my lateral and completion procedure?

Cores-lithology, mineralogy, porosity, permeability, TOC, existence of naturally occurring fractures and storage rock

1. Conventional core
2. Rotary sidewall cores
3. Percussion sidewall cores

Seismic

1. 3-D
2. 2-D

The ever increasing lateral length and the number of frac stages being pumped!

- Improved horizontal drilling technology, better understanding of the geology, improved mud technologies have allowed for longer horizontal lateral lengths
- Trend towards pumping more smaller frac stages
- Encana-Anderson 17H-1 TD 19,547' with a 7,300' horizontal lateral and 30 frac stages
- 2005 Encore-Joe Jackson 4-13H lateral length 1,650' and 3 frac stages

The ever decreasing target interval. Can I keep a 7,000' horizontal lateral in a 25' target window?

- **Minor variations in lithology are important**
- **Natural occurring fractures and/or storage rock to enhance productive capacity of source rock (carbonate-shale or sandstone/mudstone-shale complex)**
- **Lithology can greatly enhance fracture propagation and maintenance**
- **Improved drilling technology has allowed operators to "squeeze" the target window which has resulted in better completions and increased EUR's**

How does subsurface geology impact designed lateral length or actual lateral length experienced?

- **Depth of target formation**
- **Strike and Dip of sub surface structure**
- **Natural stresses in formation that will enhance stimulation**
- **Existence of faulting**
- **Tectonic activity to enhance fracturing and productive capacity**

Do I need to acquire a 3-D survey?

- Knowledge of the geology of the basin
- Availability of sub-surface control in the basin being explored
- Existing 2-D seismic coverage
- High resolution seismic may identify "sweet spots" within the basin for targeted exploration

We are in the worst drought in 50 years and the State won't let me use groundwater for fracture supply fluid anymore!

- Hydraulic fracture stimulation requires massive amounts of water (3.5-5 mm gallons per well)
- Ever increasing concern among local, State and Federal (EPA) governmental agencies
- Re-cycling encouraged (recoveries in the 20% range)
- Haynesville alone over 2000 units x 7-8 wells per unit x 4 mm gallons per well=60 billion gallons of water

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- **Protection of USDW from fracture stimulation activities**
- **State of Louisiana “strongly encourages” the use of surface water for hydraulic fracture supply**
- **Are new fracture techniques like Gasfrac the answer?**