#### AV" Unconventional" Discovery Thinking in Resource Plays: Haynesville Trend, North Louisiana\*

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#### **Selected Reference**

Beer, J., C. Neumann, J. Fleckenstein, S. Peiffer, and C. Blodau, 2009, Influence of groundwater flow on sediment pore-water biogeochemistry: Geochimica et Cosmochimica Acta, v. 73/13S, p. A102.

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Forward-looking information respecting anticipated 2010 cash flow for Encana (post transaction) is based upon achieving average production of oil and gas for 2010 of between 3.2 and 3.3 Bcfe/d, commodity prices for natural gas of between NYMEX \$5.50 - \$6.15/Mcf, crude oil (WTI) between \$65.00 - \$85.00, U.S./Canadian dollar foreign exchange rates between \$0.85 - \$0.96 and an average number of outstanding shares for Encana of approximately 750 million. Assumptions relating to forward-looking statements generally include Encana's current expectations and projections made by the Company in light of, and generally consistent with, its historical experience and its perception of historical trends, as well as expectations regarding rates of advancement and innovation, generally consistent with and informed by its past experience, all of which are subject to the risk factors identified elsewhere in this presentation.

Furthermore, the forward-looking statements contained in this presentation are made as of the date of this presentation, and, except as required by law, Encana does not undertake any obligation to update publicly or to revise any of the included forward-looking statements, whether as a result of new information, future events or otherwise. The forward-looking statements contained in this presentation are expressly qualified by this cautionary statement.



# Haynesville / Bossier Shale Discovery Acknowledgements

#### **Contributors:**

Land Capture & Exploration - Encana New Ventures Team, David Hill, Tom Smagala, Andrea Stienle, Gary Houghton, Alastair Nichol, Tim Duplantis, Richard Newhart, Peter Smith, Brent Miller, Mark Tobey

Pilot to Commercial Demonstration – Encana New Ventures Team, Encana Mid Continent B.U., Shell North American Exploration

Commercial Development – Encana Mid Continent B.U., Texana Team, Shell North American Exploration

#### **Permission & Materials:**

**Encana Corporation** 



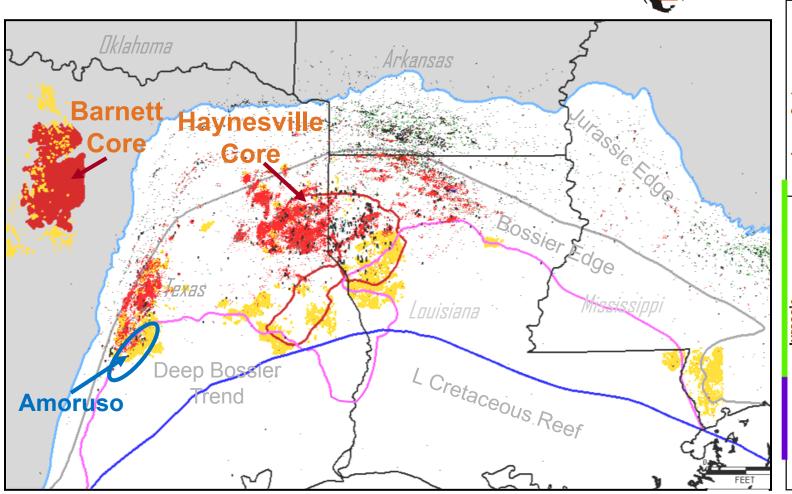
# Haynesville / Bossier Shale Discovery Technical Perspective

- Vintage Maps
- Discovery Concepts
- Play Evolution
- Technology Uses
- Current Status



### **Gulf Coast Jurassic Trend**

> 1 Million Acres on Trend



Glenrose Rodessa Sligo **Travis Peak** /Hosston Knowles Cotton Valley Group Bossier Jurassic Haynesville **Smackover** Norphlet Luann salt

**<b>☼** Jurassic Production

100 mi.

### **Jurassic Trend**

### Deep Basin Gas Cell Attributes

Is a continuous-type gas accumulation



Lack obvious seal/trap



Areally &/or vertically pervasive



 Gas prone source proximal to reservoir



Gas saturated



Gas generation window



Abnormally pressured



Often have enhanced φ / k
 sweet spots



Lack a downdip water contact



 Updip transition to wet or discontinuous reservoirs



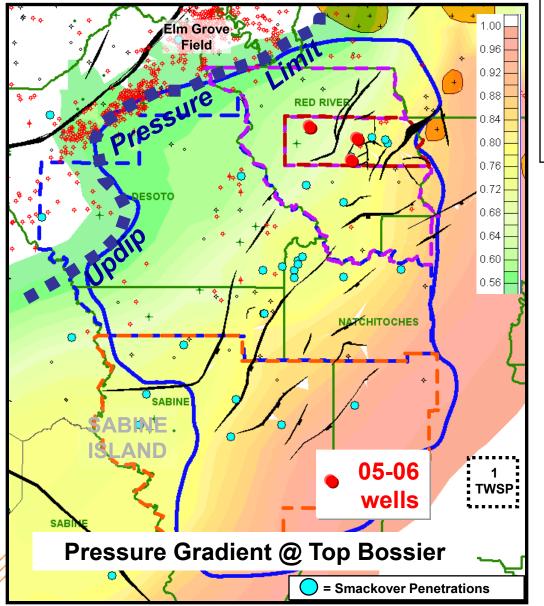
Low φ (<10%) & k (<0.1 md) matrix



Large OGIP, low RF



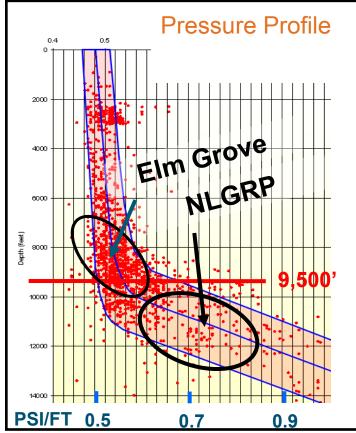
# North Louisiana Resource Play Vintage Map



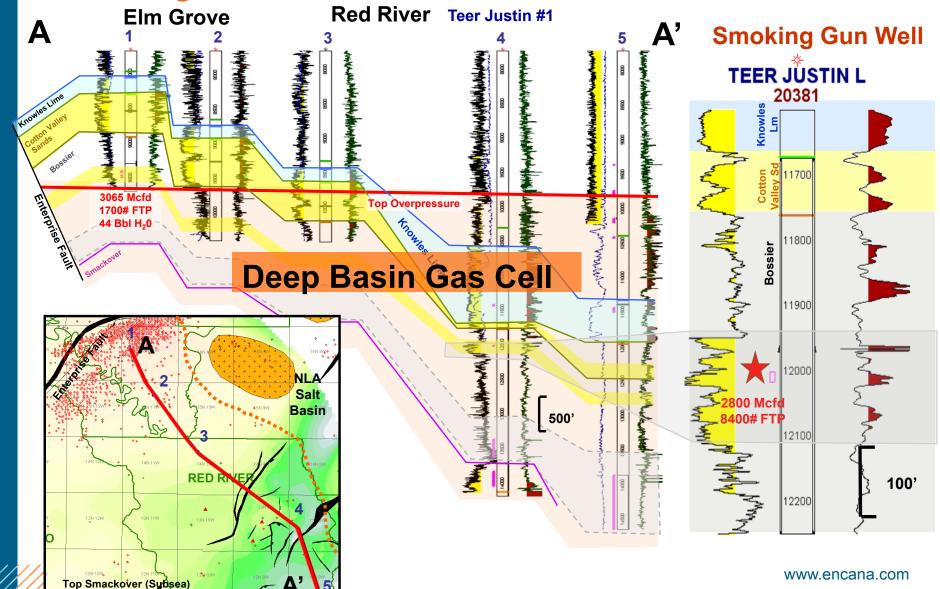
### **Pressure Gradient Map:**

generated using a mud weight to depth and pressure relationship

•Top of Bossier overpressure occurs at approximately 9500' (~.55psi/ft)



# North Louisiana Resource Play Vintage Cross Section



## **Execution Methodology**

### Haynesville Shale Example

Resource Play Methodology

**Land Capture Exploration Pilot** Wells Commercial **Demonstration** Commercial **Development** Play **Optimization** 

Acquired 340,000 acres

• Drilled 8 vertical, 1 Hz test

Drilled 5 horizontal pilots

Expanded land position

Ramped up rig count

Validated type curve

Ramping to over 20 rigs

Managing costs

Down spacing

Frac optimization

Gas Factory execution

Time Period

20052006

2007

2007

2008

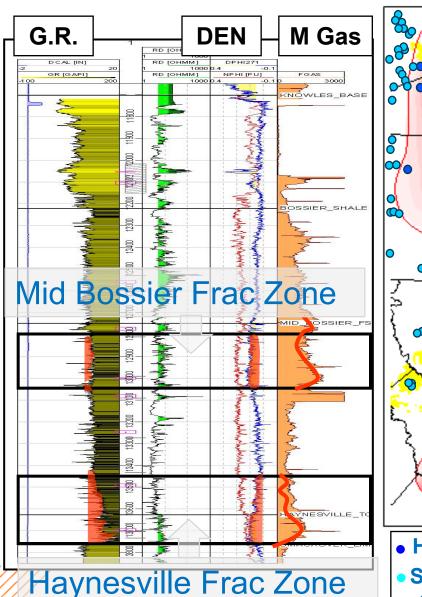
2008 2009

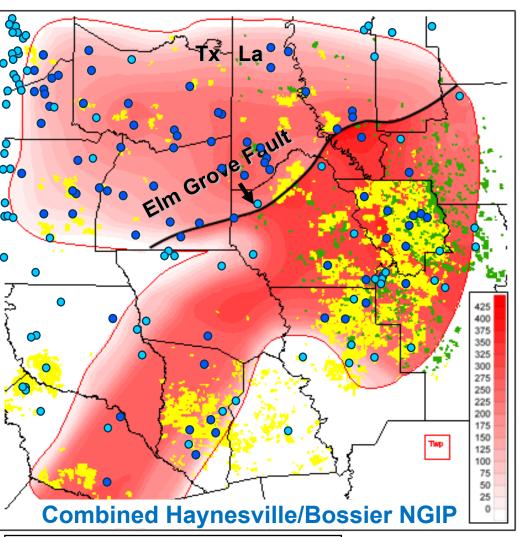
2010F

2011+F

### **Ease of Mapping Play**

**Strong Log Signature & Good Well Control** 



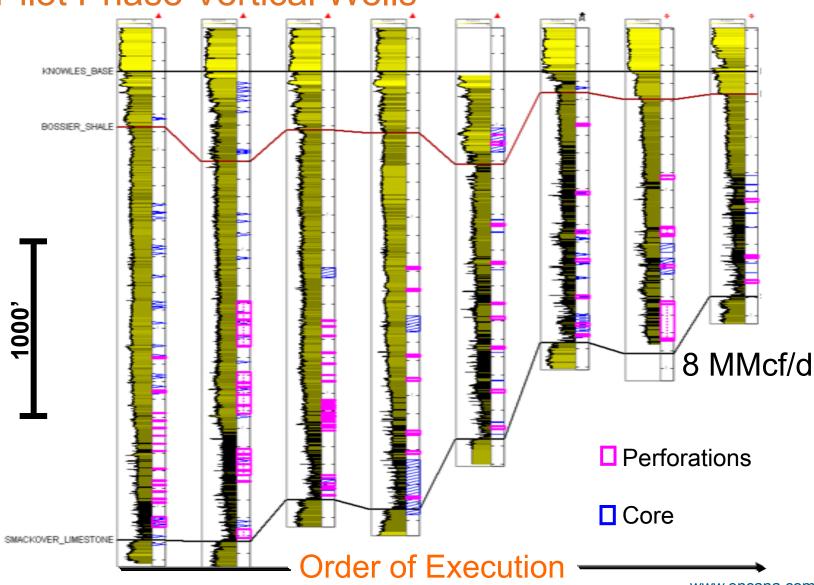


HSVL OGIP control - 80 wells

SMCK penetrations - 262 wells4,500 miles Seismic

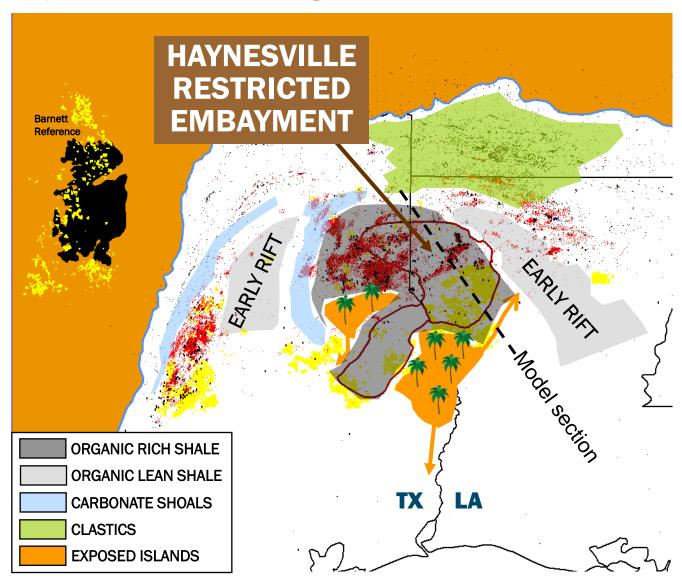
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## Haynesville / Bossier Shale Pilot Phase Vertical Wells



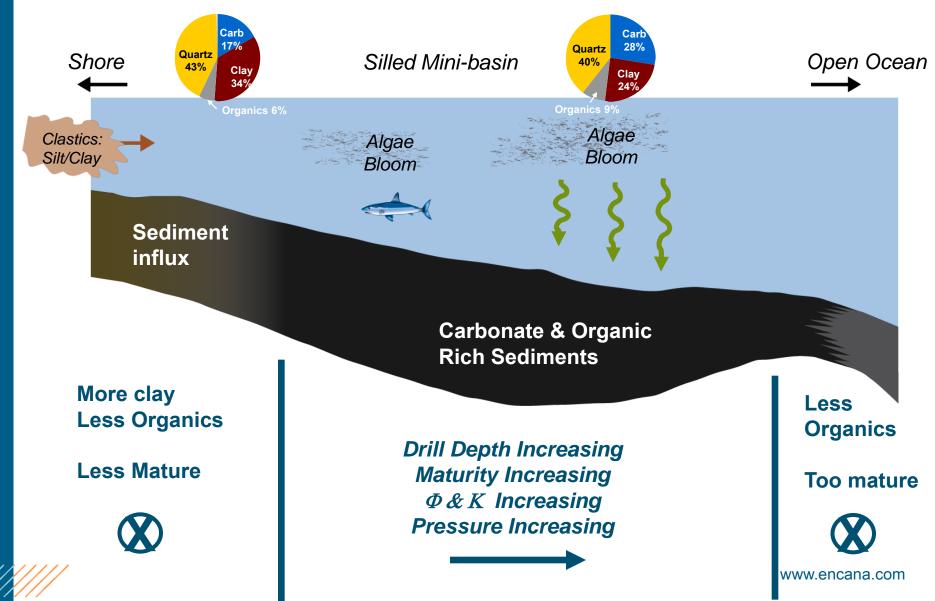


## Haynesville Depositional Setting

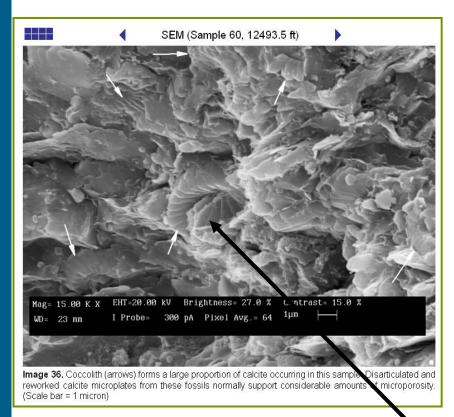




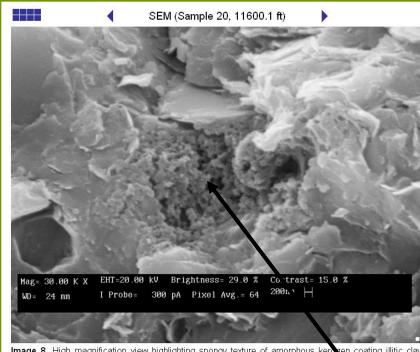
## Rock Quality Variations Shale Mini-basin



## Haynesville Porosity System



Grain support from coccolith debris

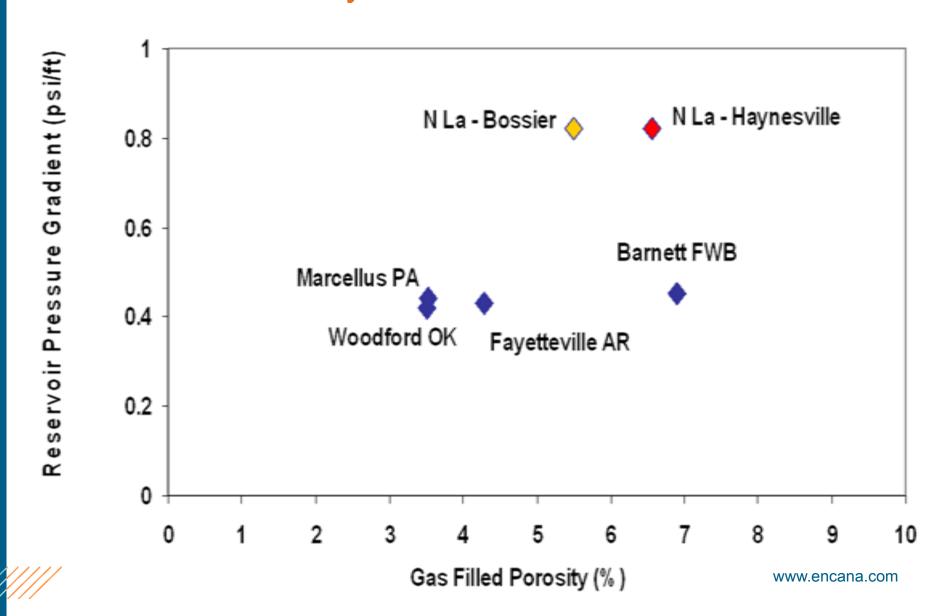


**Image 8.** High magnification view highlighting spongy texture of amorphous kerogen coating illitic clay minerals in the matrix. Increased organic matter (TOC = 3.1) finely distributed in the matrix contributes to increased opacity in like Sample 16. (Scale bar = 200 nanometers)

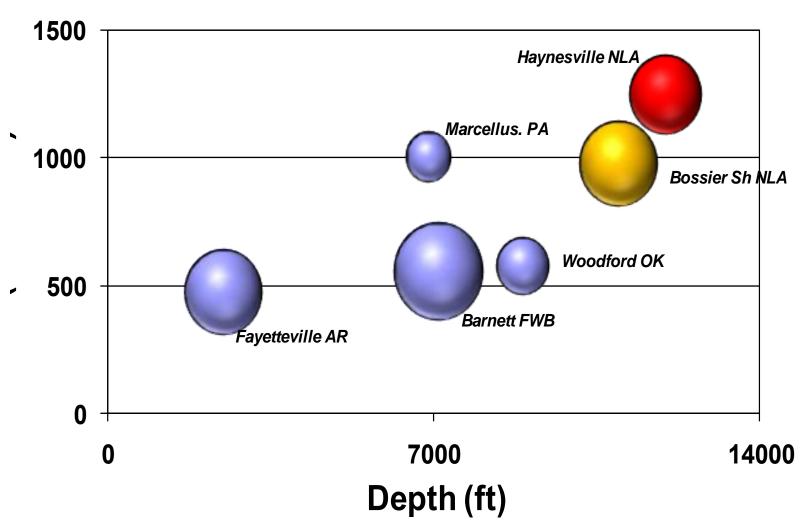
Porosity in mature organic matter



## Haynesville / Bossier Shale Reservoir Quality Vs. Pressure Gradient



## Haynesville / Bossier Shale Exceptional Reservoirs



Play Mean Values
Bubble size – relative thickness

12000

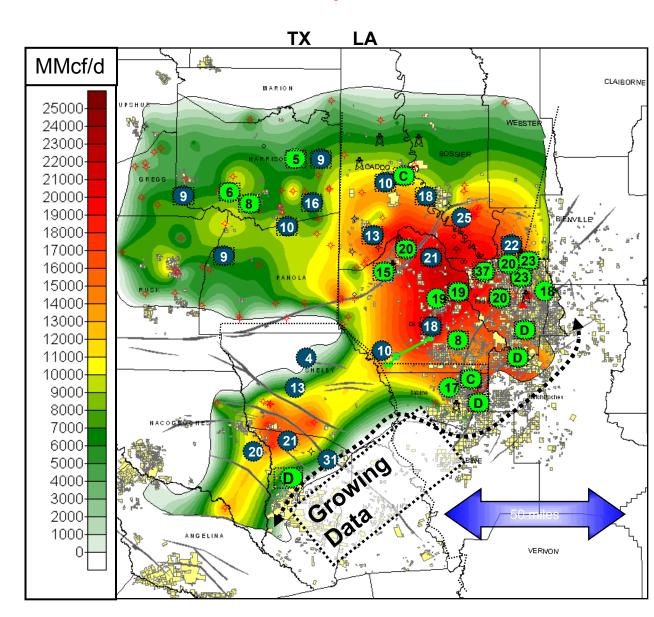
11000

6918

# Performance Quality Variability Haynesville Predicted/Actual IP Map

### **Quality Function of:**

- Mineral Make-up
- Clay
- Porosity
- TOC
- Pressure





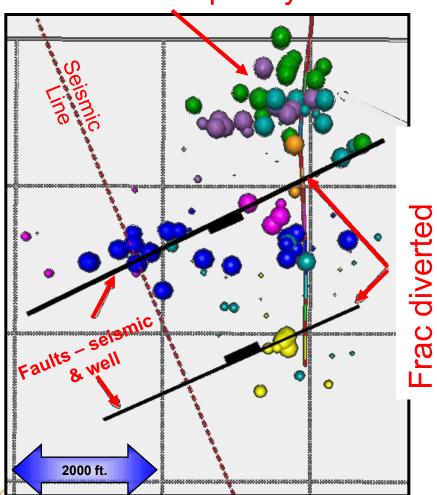
## Haynesville / Bossier Shale Technology Challenges – Deep Trend

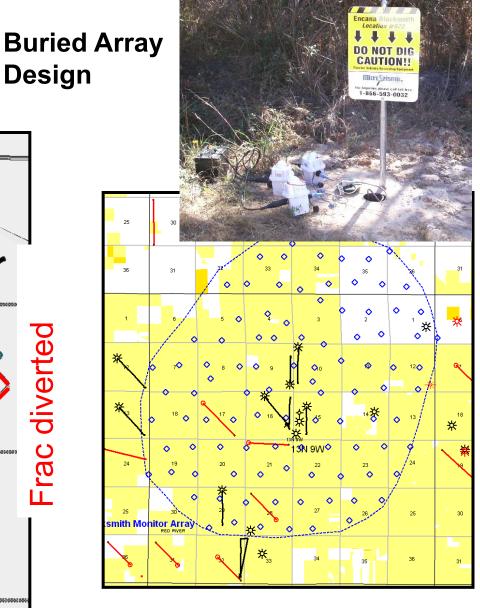
- High temperature: 370+ degree F
- Pressure: 11,000+ PSI BHP
- Proppant placement
- Structure complexity

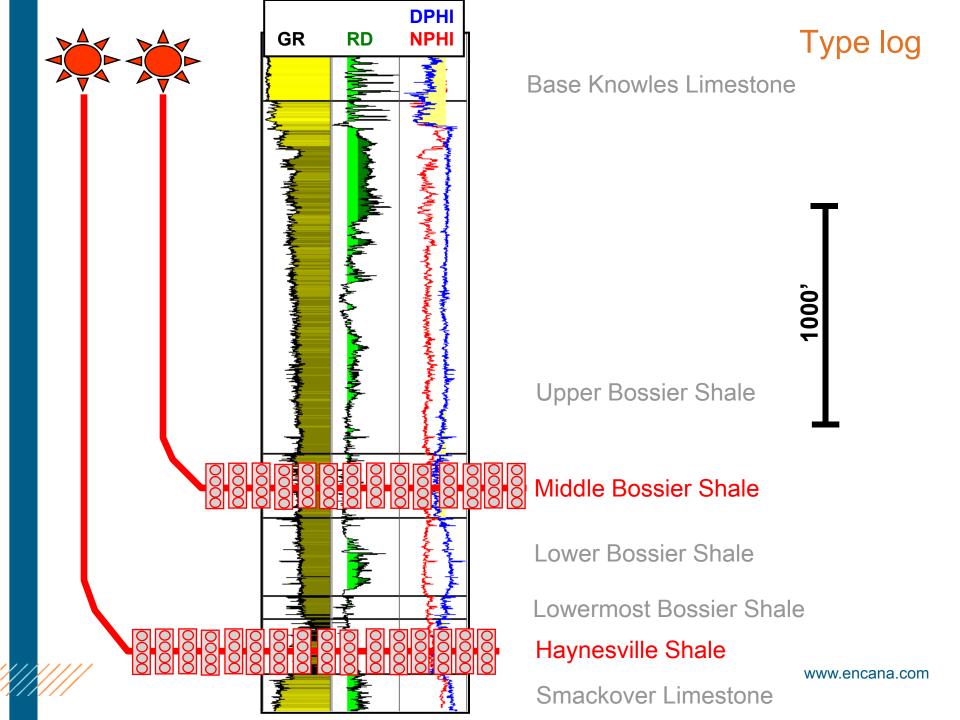


## Micro-seismic array Red River PA

Frac complexity





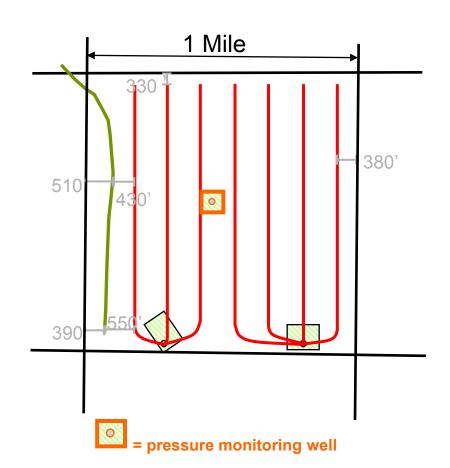


### Haynesville

### Manufacturing Process

### Step Change in Development

- Gas Factory
  - Multi-well pads; simultaneous operations
  - Manufacturing process
  - Skidding FFP rigs
  - Single pipeline connection
  - Reduced overall foot print
- Downhole spacing ~660 feet
- Well orientation N-S
- 4,000'+ laterals (12+ stages)
- Improved overall gas recovery





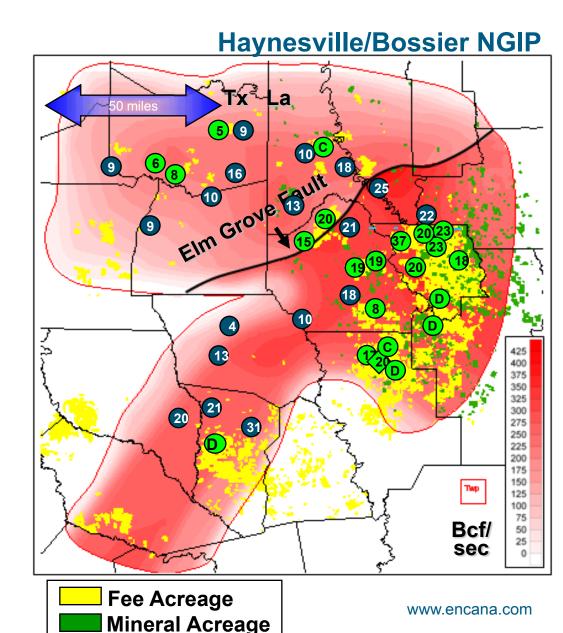
### Haynesville Well Performance

### Imagine...

- Gas Factory
   Development
- Longer laterals / more stages
- Simo-ops / Simo-fracs
- Existing infrastructure

IP as reported (Generally Peak Day)

- Industry HSVL
- **20** ECA JV HSVL



### Haynesville Well Performance

### Confidence in Productivity

Well rates limited by infrastructure flowing pressures: 7,000 to 10,000 psi

Gas Rate (MMcf/d) 40 35 Productivity increases driven by: Additional frac stages 30 Refining perforation clusters 20 stages 25 Increased proppant concentrations 20 15 12 stages 10 7.5 Bcf Type Curve 5 12 Fracs 0 500 1,000 1,500 2,000 2,500 3,000 Cumulative Gas (MMcf)



### Haynesville and Mid Bossier NGIP

Overlap of 100+ Bcf/section in each zone

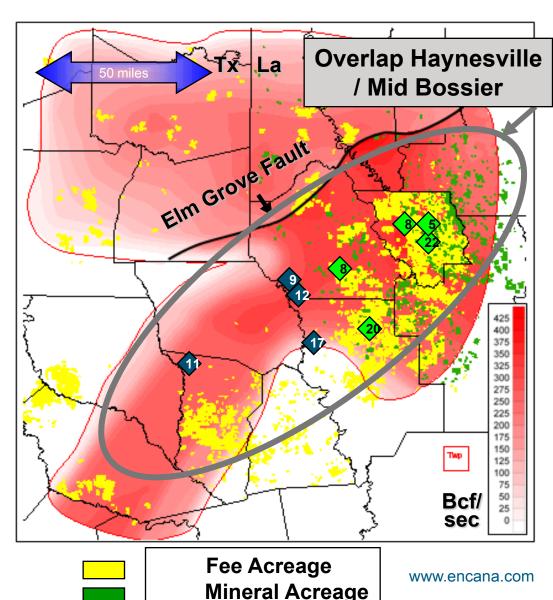
### Imagine...

- Stacked pay
- Potential longer laterals
- Double well count
- Double production volumes
- Existing infrastructure

IP as reported (Generally Peak Day)

1 Industry MBSR

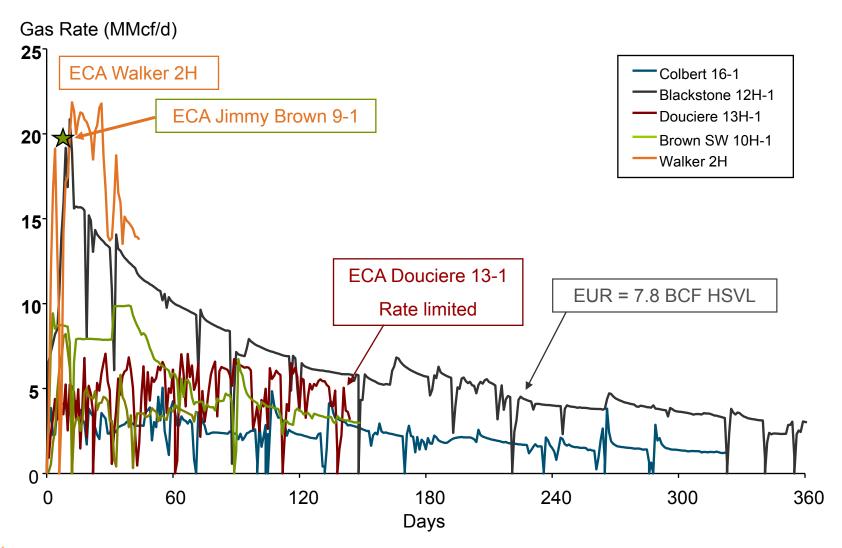






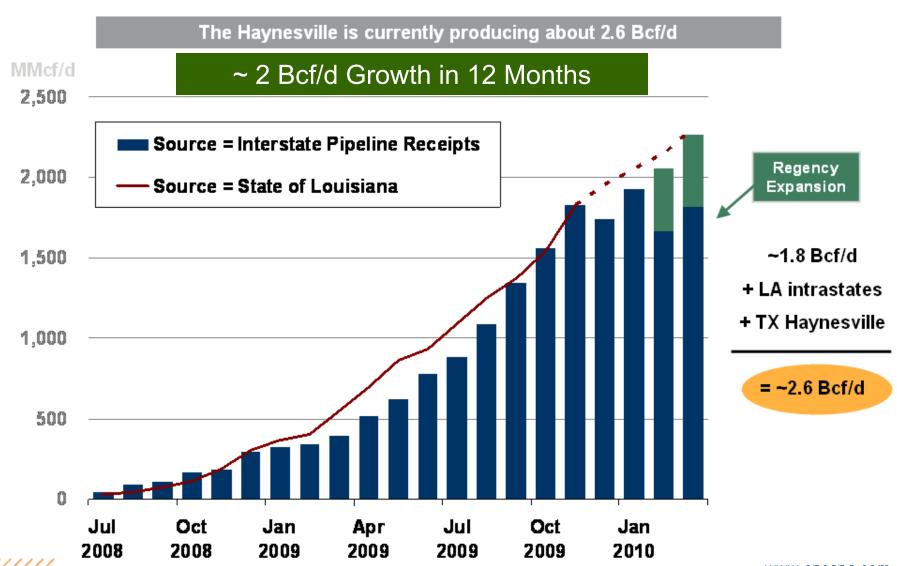
### **Bossier Shale Performance**

Mid Bossier - Haynesville Comparison



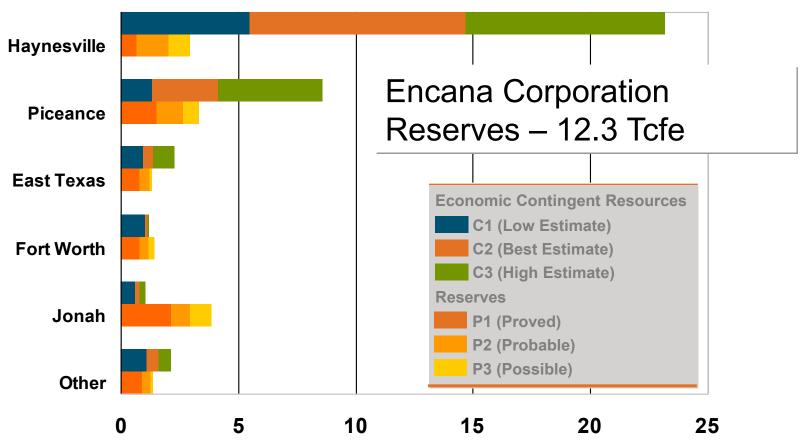


## Haynesville Area Production



## USA Division Tremendous Resource Potential

Reserves and Economic Contingent Resources (Tcfe)\*



<sup>\*</sup> Evaluated by Independent Qualified Reserves Evaluators as at December 31, 2009



## Haynesville / Bossier Play World Class Resource





### For More Information

## Techologies advance plays – people discover them!

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