# Shale Gas Supply Issues
# An Alternate Scenario to Consider

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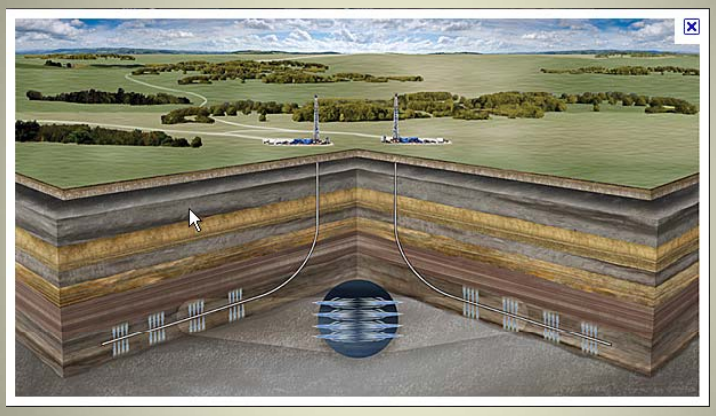
## Shale Gas and Multi-Stage Fracture Stimulation

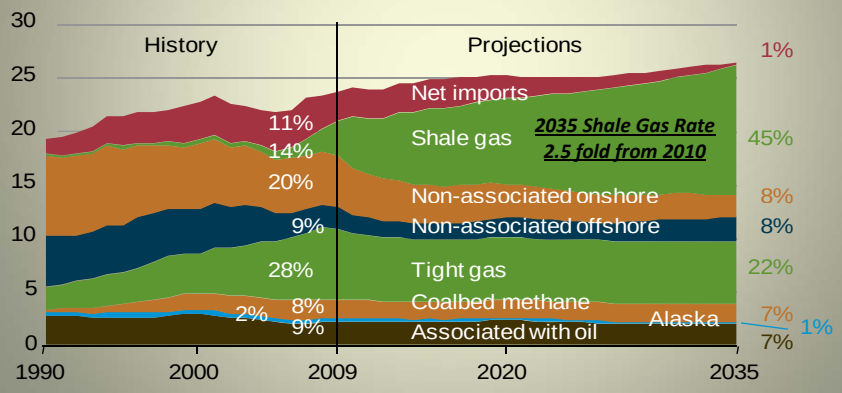


Horizontal sections 4,000 ft to 10,000 ft in length
6-15 multi-stage fracture stimulations

## EIA Forecasts 225 Tcf of Shale Gas Produced From 2010-2035

### (150% Increase in rate from 2010-2035)

Figure 1. Shale gas offsets declines in other U.S. supply to meet consumption growth and lower import need




Sources: History: EIA, Annual Energy Review 2009. Projections: National Energy Modeling System, run REF2011.D120810C.

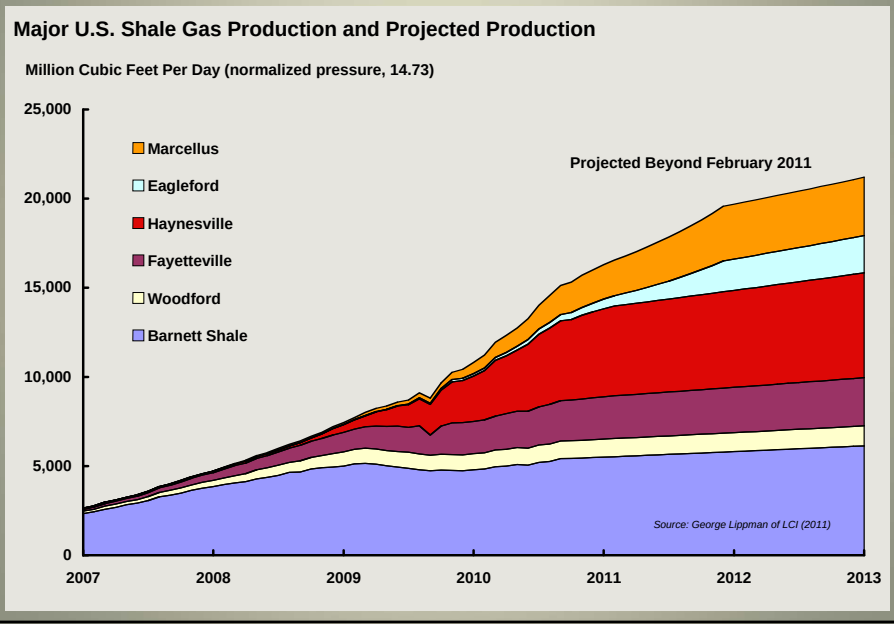
## 2010-2035 Forecast

- **For the period, the EIA forecasts a modest 10% increase in overall gas supply.**
- **This 10% increase relies heavily on growth of shale gas, growth of 150%.**
- **Success of a major policy change in usage of natural gas will be highly dependent on the viability of shale gas production.**

# Potential Gas Committee (2009 Report)

- Upside Resource = 1,836 Tcf Technically Recoverable (Proved + Probable + Possible + Speculative)
  - Shale Gas = 616 Tcf, In Effect ~27 Years of Supply.
- Proved + Probable Resource = 441 Tcf or ~19 Years of Supply.
  - Probable Estimate is Shale Gas = 147 Tcf, ~6.5 Years at Current Consumption.
  - Substantially less than EIA forecasted production 2010-2035 (225 Tcf) .

# Forecasted Production By Area



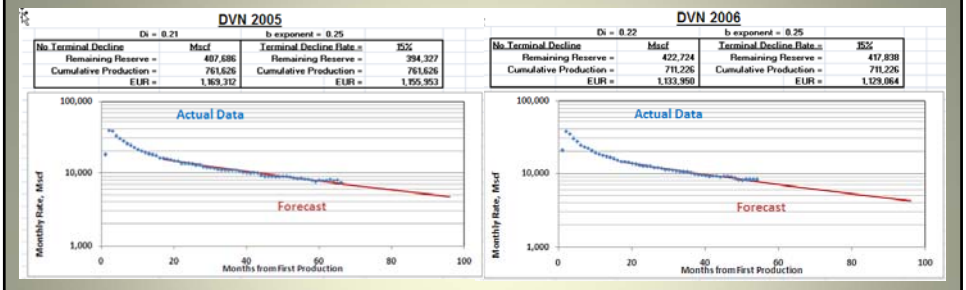
# Performance of Shale Gas Plays
# Independent View

| | Ulimate Recovery Per Well Estimates | |
|---|---|---|
| Shale Play | Berman/Pittinger Studies | Operator Presentations |
| Barnett | 1.26 Bcf | 2-2.5 Bcf |
| Fayetteville | 1.2 Bcf | 2-2.5 Bcf |
| Haynesville | 2.5 Bcf | 6-10 Bcf |
| | 4.6-4.8 Bcf in Core Area | 10 Bcf |
| Marcellus | No Public Monthly Data | 4-4.5 Bcf |

1) Our decline curve analysis yields 50% or lower estimates for ultimate recovery per well for each area.

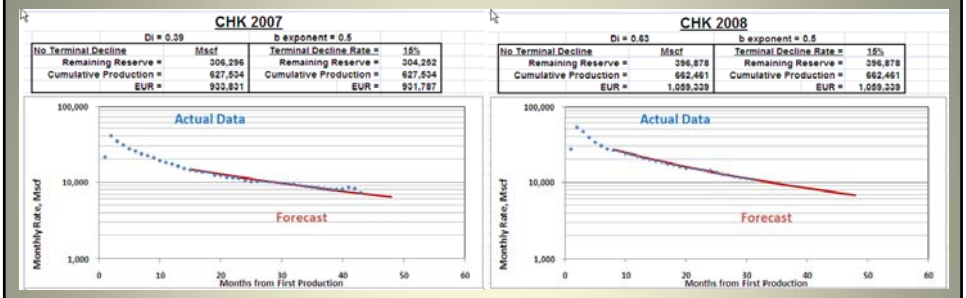
2) Core areas perform better, but are limited in areal extent.

# Barnett Production Decline Analysis



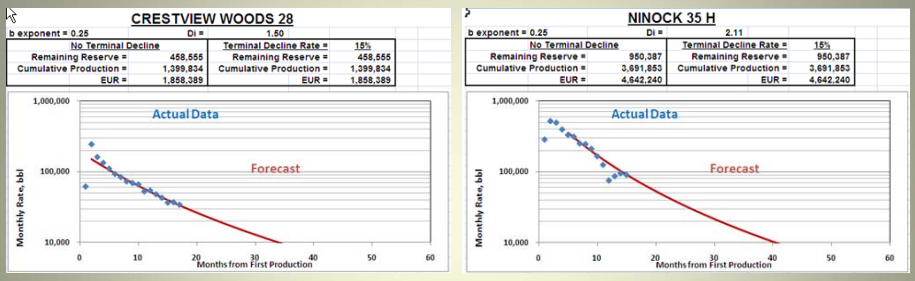

| Well | EUR, Mscf | b exponent | Number of Wells |
|---|---|---|---|
| DVN 2003 | 1,544,088 | 0.10 | 55 |
| DVN 2004 | 1,419,594 | 0.25 | 91 |
| DVN 2005 | 1,155,953 | 0.25 | 159 |
| DVN 2006 | 1,129,064 | 0.25 | 285 |
| DVN 2007 | 1,318,622 | 0.25 | 459 |
| DVN 2008 | 1,340,464 | 0.25 | 573 |
| DVN 2009 | 978,684 | 0.25 | 286 |
| DVN 2010 | 1,320,071 | 0.25 | 398 |
| WEIGHTED AVG EUR | 1,256,857 | TOTAL WELLS | 2,306 |

# Fayetteville Production Decline Analysis



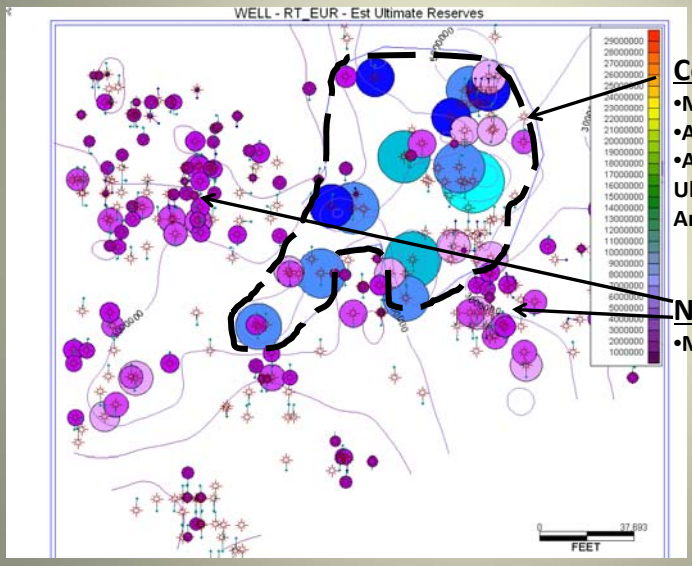

**Average Ultimate Recovery = 1.2 Bcf/well for ~ 2,000 wells**

# Haynesville Production Decline Analysis




* **Mean Ultimate Recovery of 124 wells analyzed = 2.5 Bcf/well**
* **Core area has a higher mean of 4.6-4.8 Bcf/well**

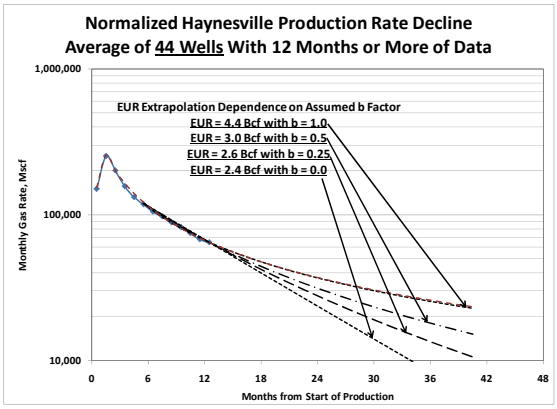
# Haynesville Core Area




**Core Area** *(6/10 study)*
- Mean EUR = 4.6 Bcf
- Area ~ 160,000 acres
- At 120 acres/well, Ultimate Recovery in Core Area ~= 6.1 Tcf

**Non-Core Area**
- Mean EUR = 2.1 Bcf

# Haynesville – Ultimate Recovery & Economics

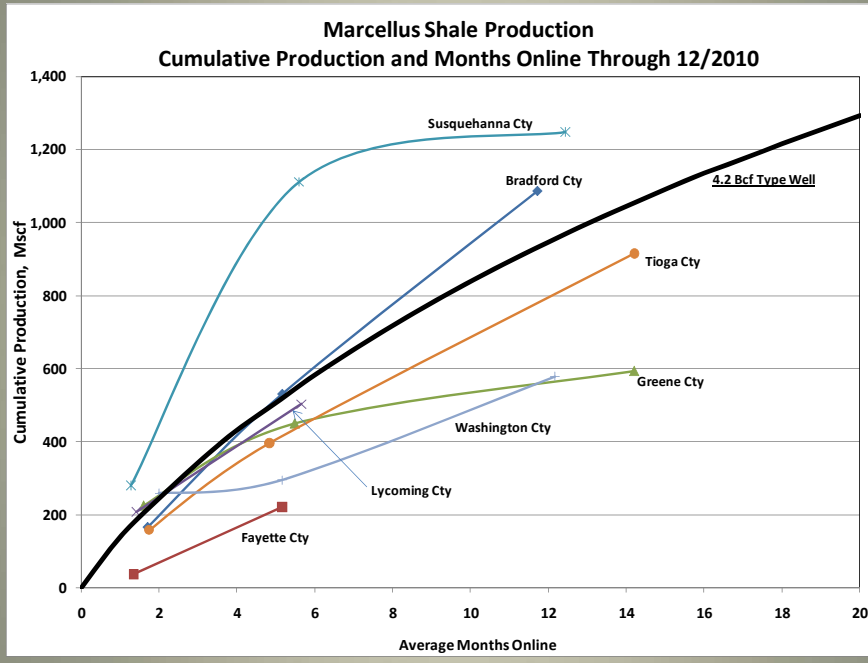



**Breakeven Gas Price, $/MMBtu @ Wellhead**

*(at 10% Discount Rate)*

| EUR Scenario | EUR/Well, Bcf | Full Cycle |
|---|---|---|
| Group Avg, Projected w/ b = 0 | 2.3 | $9.00 |
| Group Avg, Projected w/ b = 0.5 | 3.0 | $7.80 |
| Group Avg, Projected w/ b = 1.0 | 4.4 | $6.70 |
| Operator View, 14 MMsfd IP, b=1.07 | 6.5 | $4.70 |

*$8MM/well, $5,000/acre, 120 acre/well, ½ of land leased is fully developed*




# "Land Rush" Business Model

- Recent shale plays leased up in 2-3 years before plays are fully tested
- High volume of drilling, driven in part by need to hold acreage
  - 1 well per 640 acres to hold leases that would otherwise expire in 3-5 years
- Need to tell growth story to investors
  - Capital spending exceeds cash flow
  - Large write-downs
- Result : Excess gas supply, keeping prices very low
  - Natural gas sell for 75% discount on energy equivalent basis to oil
  - Probably not sustainable in the long term
- *Awareness of actual well performance should increase*

# Summary – Uncertainty Abounds in Shale Gas Supply

- **Shale gas development is not a "manufacturing" process that is consistently repeatable across the entire area of the play:**
  - **Quality and geology matters,**
  - **Sensitive to Price.**
- **Major policy discussions of expanding use of natural gas should consider a downside scenario for shale gas as compared to EIA forecast** ***(12 Tcf/yr in 2035, 220 Tcf produced between 2010-2035)***
  - **Shale gas may disappoint by a factor of 2 to 4,**
  - **EIA forecast volumes are more likely with substantially higher natural gas prices.**