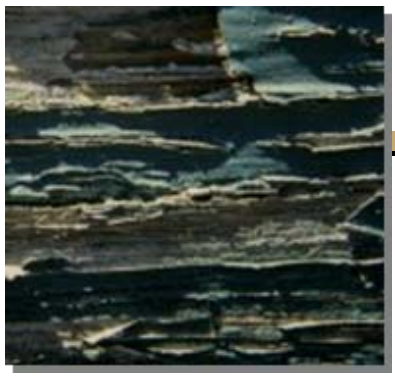

UNCONVENTIONAL NATURAL GAS:

INDUSTRY SAVIOR OR BRIDGE?

Prepared for:
2006 EIA Energy Outlook and Modeling Conference

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Washington, DC

UNCONVENTIONAL NATURAL GAS:
INDUSTRY SAVIOR OR BRIDGE?

Not That Kind Of Bridge!

Maybe If We Turn Into Wood Chips?

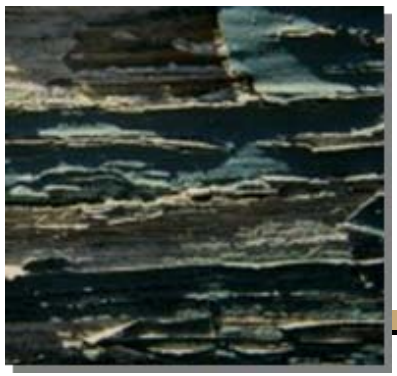
Now, That's More Like It!

INTRODUCTION

The presentation draws on 30 years of experience in unconventional gas, including a host of resource studies and numerous “on the ground” development projects.

“We were working on unconventional gas before it was respectable to do so.”

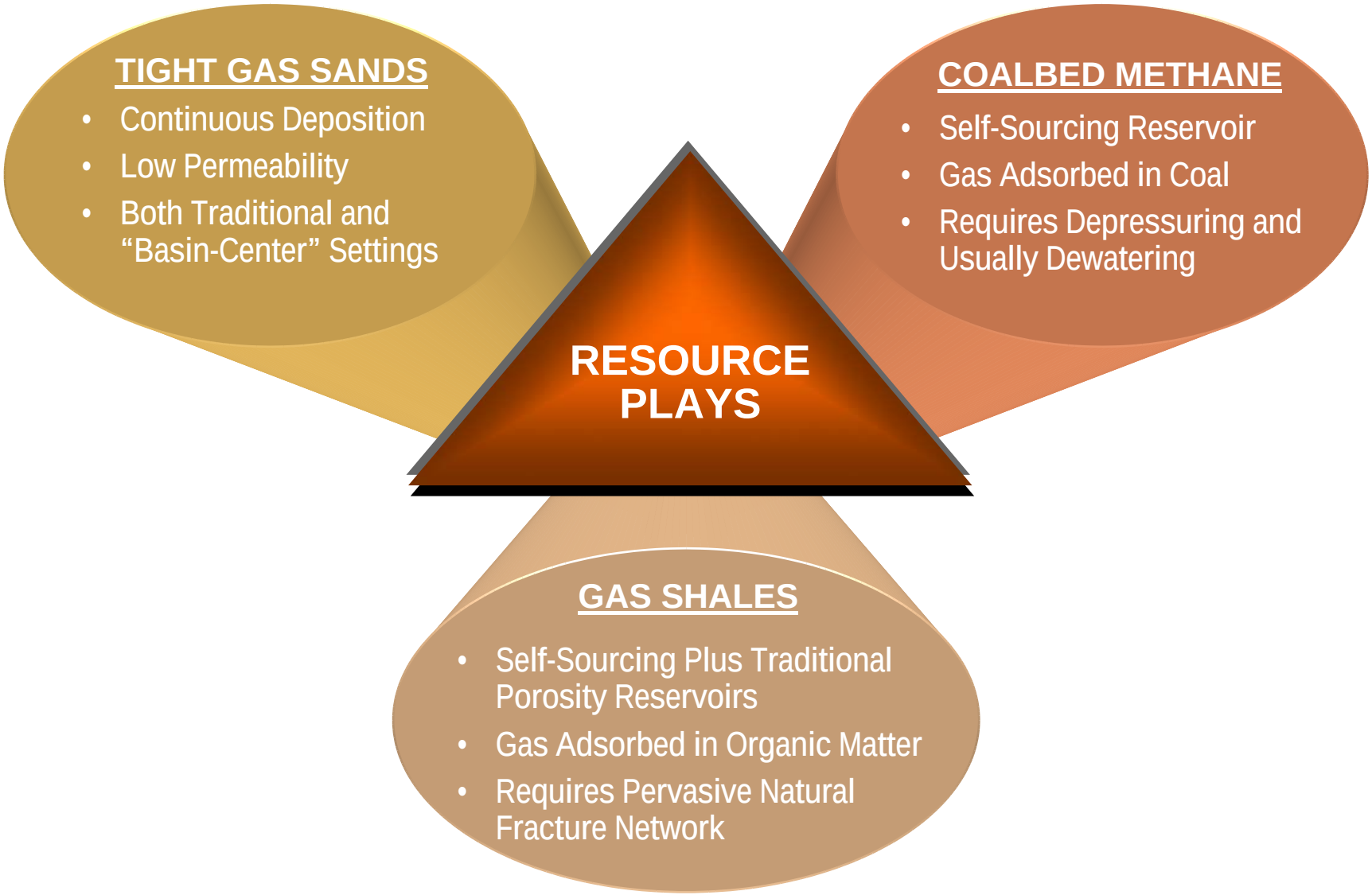
The presentation also captures insights from our recent update of the recoverable resources, performance and technology status of significant U.S. unconventional gas plays.



1. BACKGROUND AND PERSPECTIVE

- Why is “unconventional gas” unconventional?
- What is the status of and outlook for unconventional gas in the U.S.?

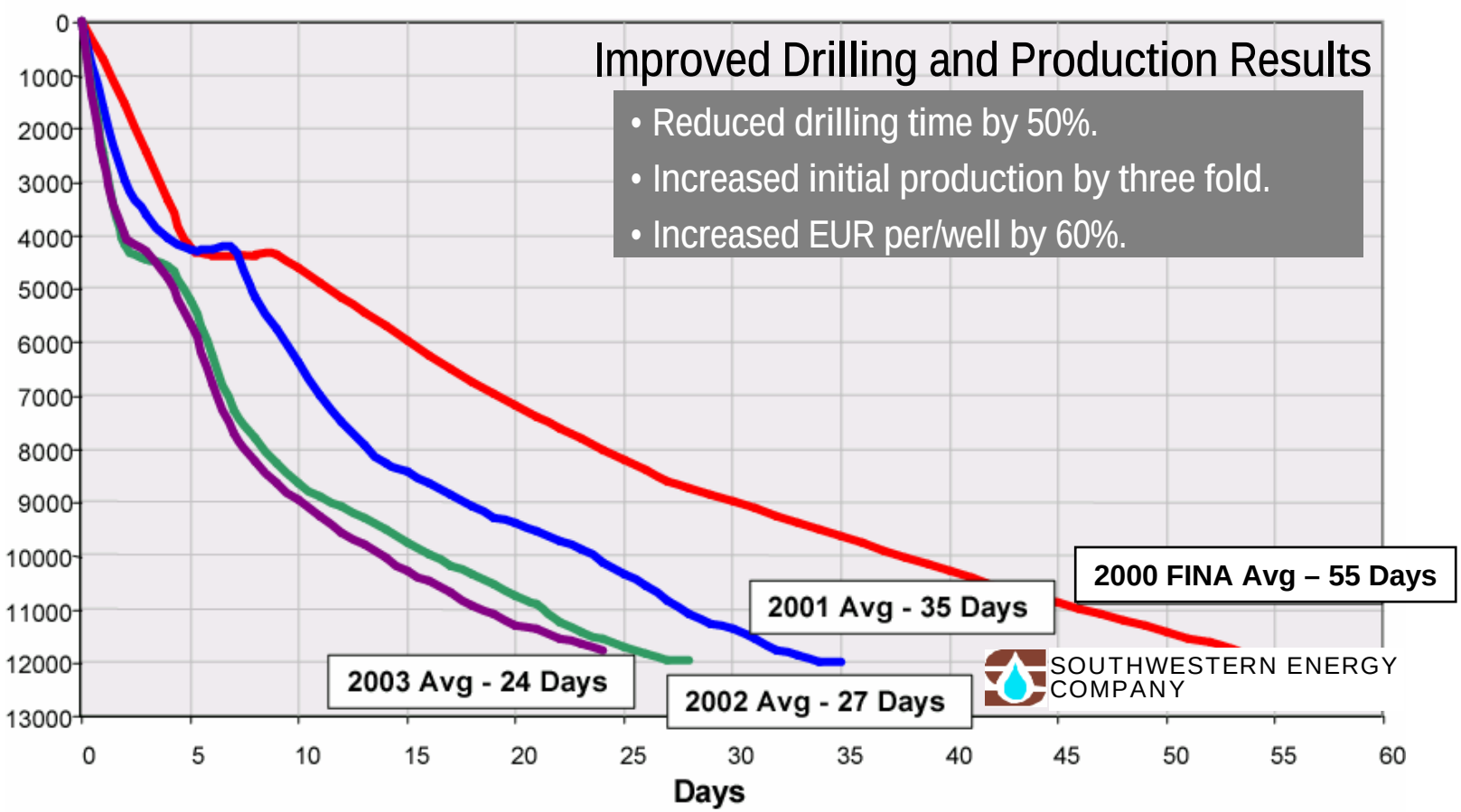
UNCONVENTIONAL GAS AND RESOURCE PLAYS



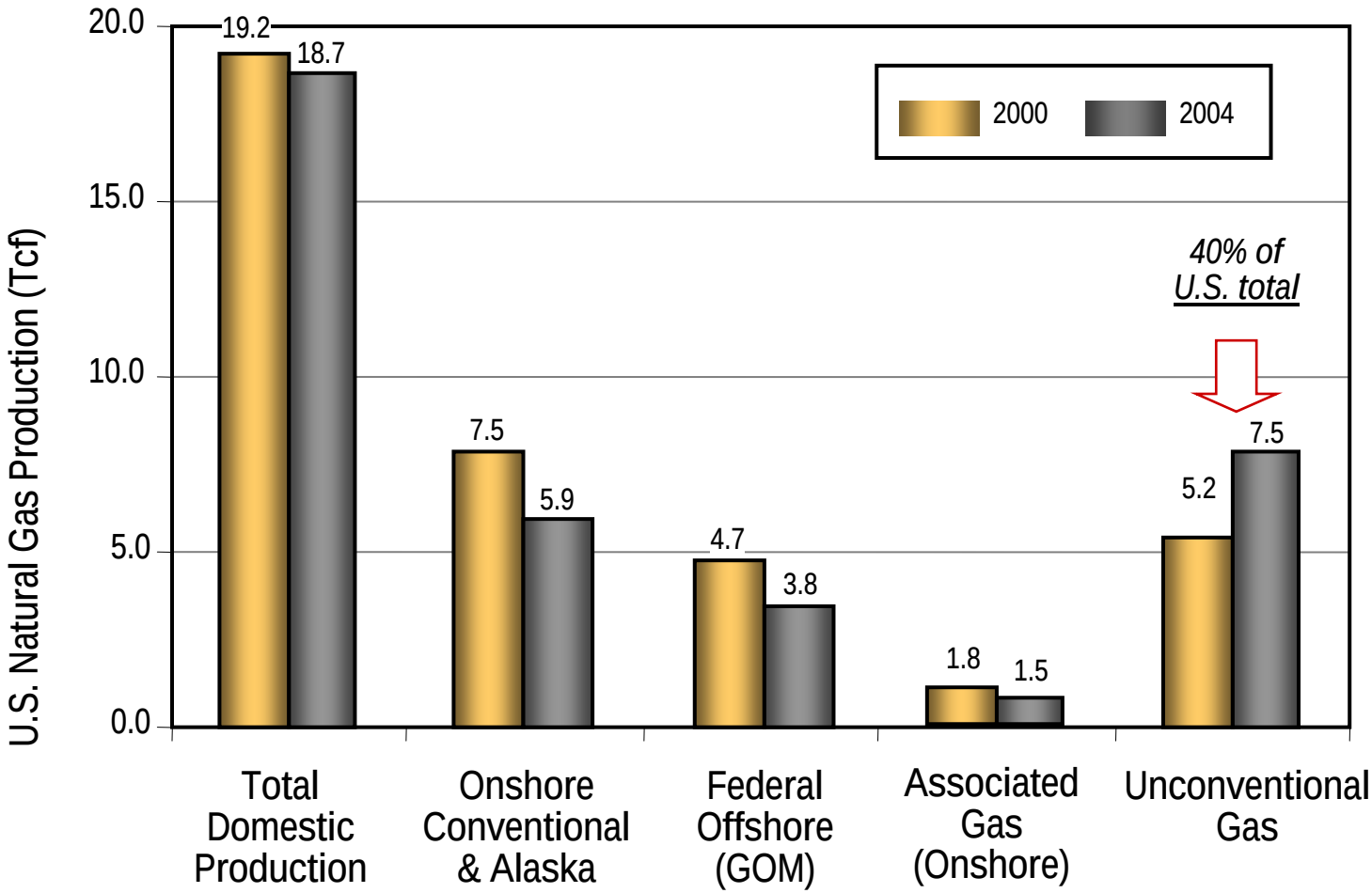
WORKING DEFINITION OF UNCONVENTIONAL RESOURCES

- **A Volume of Hydrocarbons Trapped by a Convergence of Several Geologic/Physical Mechanisms**
  - **Low Matrix Permeabilities (<0.1 md) - Adsorption Mechanisms**
  - **Abnormal Pressure - No Obvious Reservoir Seal**
- **They Require <u>Changes</u> in Standard Operating Practices**
  - **Favorable Reservoir Paradigm**
  - **Wellbore and Completion Designs**
  - **Well and Formation Testing Procedures**
- **<u>They Must be Made Economic Through the Efforts of the Operator</u>**

OVERTON FIELD, EAST TEXAS (COTTON VALLEY TIGHT GAS SANDS)

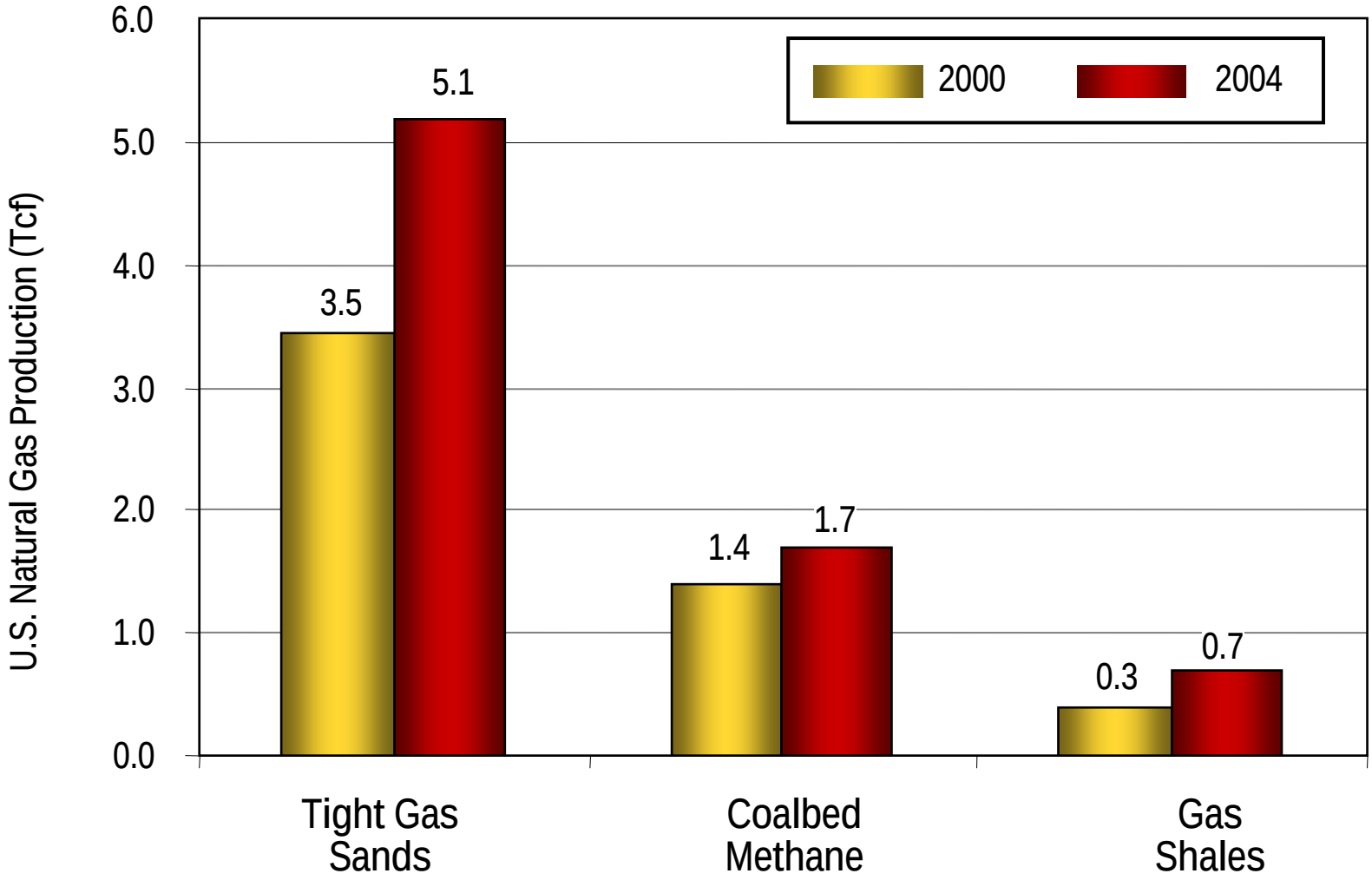


UNCONVENTIONAL GAS NOW ACCOUNTS FOR 40% OF U.S. NATURAL GAS PRODUCTION



Source: Conventional/Offshore – EIA Annual Reserve Reports; Unconventional – Advanced Resources International data base.

ALL THREE UNCONVENTIONAL GAS RESOURCES HAVE EXPERIENCED INCREASED PRODUCTION



Source: Advanced Resources International data base.

EIGHT OF THE TOP TWELVE U.S. NATURAL GAS FIELDS ARE UNCONVENTIONAL GAS FIELDS

Rank (in 2002)	Field Name	Basin/State	Type of Resource	Production (Bcfd)		
				Year 2002	Year 2003	Year 2004
1	San Juan Gas Area	San Juan, NM/CO	CBM/Tight Gas Sands	3.9	4.1	4.0
3	Newark East	Ft. Worth, TX	Gas Shale	0.6	0.8	1.1
4	Wyodak/Big George	Powder River, WY	CBM	0.9	0.8	0.9
5	Jonah	GGRB, WY	Tight Gas Sands	0.6	0.7	0.7
7	Wattenberg/DJ Basin	Denver, CO	Tight Gas Sands	0.5	0.5	0.5
9	Carthage	East Texas, TX	Tight Gas Sands	0.5	0.5	0.5
10	Antrim	Michigan, MI	Gas Shale	0.5	0.4	0.5
11	S. Piceance Gas Area*	Piceance, CO	Tight Gas Sands/CBM	0.3	0.4	0.6

*Includes Mamm Creek, Rulison, and Grand Valley/Parachute.
Note: Fourteen of the twenty largest gas fields, based on proved reserves, hold unconventional gas.
Sources: EIA 2002/2004 Annual Reserve Reports, Advanced Resources Data Base.

UNCONVENTIONAL GAS RESOURCES

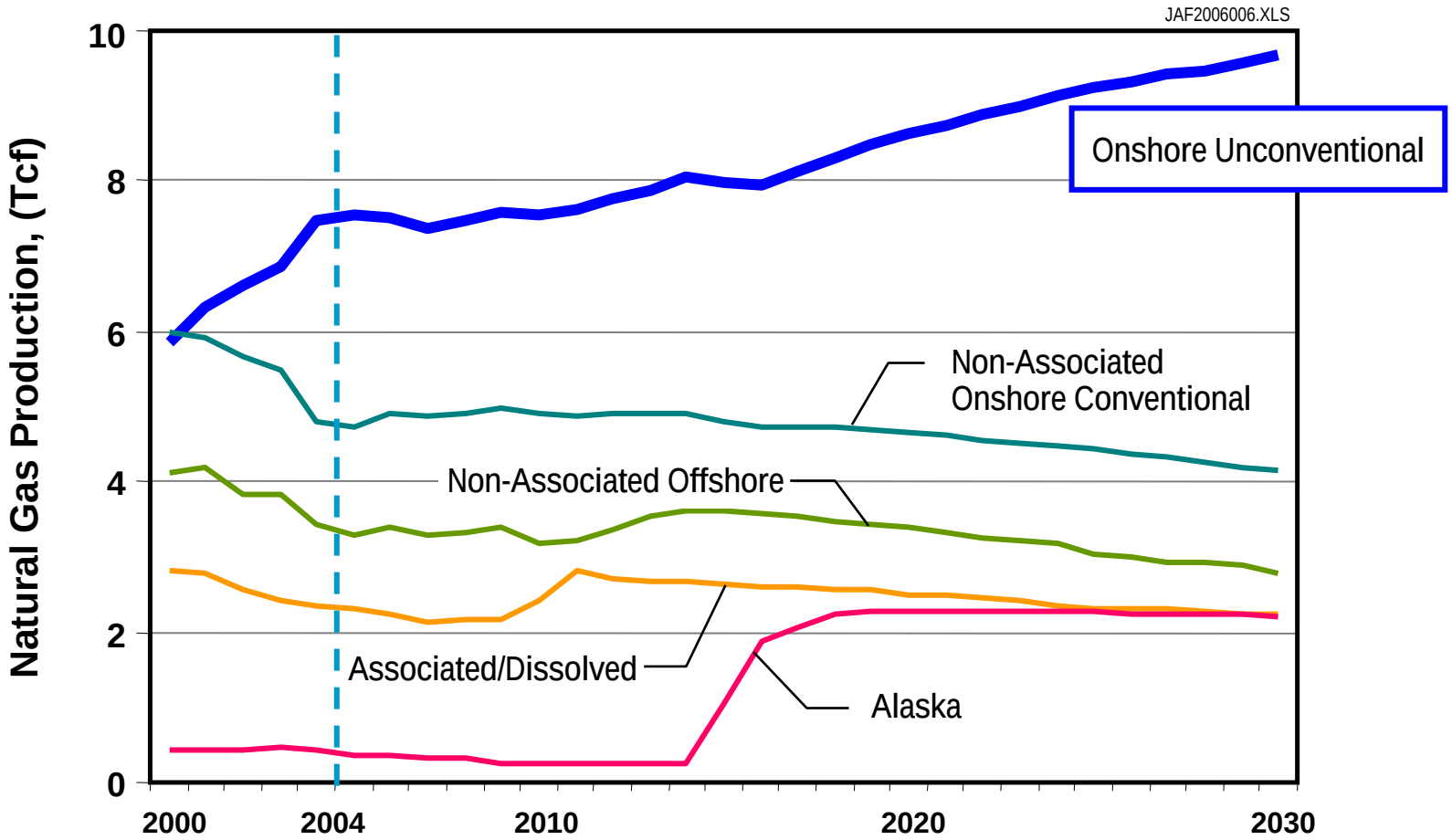
Eight of the top 10 U.S. onshore giant gas discoveries are unconventional

U.S. Onshore Gas Giants of the 1990s			
	Name	EUR (Tcf)	Play Type
1	Newark East – Barnett Shale	26.2	Continuous Shale Gas
2	Powder River CBM	24.0	Coalbed Methane
3	Jonah	3.3	Basin Centered Gas
4	Pinedale	2.0	Tight Sands
5	Madden Deep (Mostly Conventional)	2.0	Structural
6	Vernon	1.8	Tight Sands
7	Ferron Coal Play Utah	1.5	Coalbed Methane
8	Freshwater Bayou (Conventional)	1.5	Structural
9	Dew – Mimms	1.2	Tight Sands
10	Bob West	1.1	Structural/Tight Sands

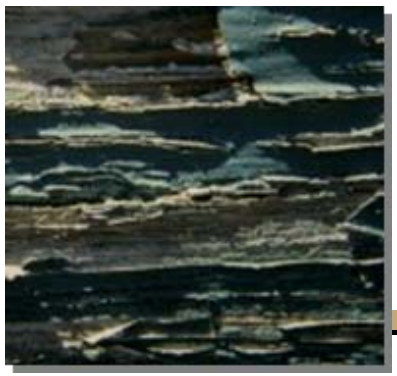
Source: Anadarko, Howard Weil 33rd Annual Energy Conference, April 2005

OUTLOOK FOR U.S. NATURAL GAS SUPPLIES (AEO 2006)

Currently, unconventional gas, the single largest source of U.S. natural gas production, provides 21 Bcfd (7.5 Tcf per year); its role is expected to grow.



Source: DOE/EIA AEO 2006



2. UNCONVENTIONAL GAS RESOURCES

- How large is the U.S. recoverable "unconventional gas" resource base?
- Why do resource estimates for unconventional gas change and differ so much?
- Where are the new unconventional gas plays?

HOW LARGE IS THE UNCONVENTIONAL GAS RESOURCE BASE?

We do not yet know the ultimate size or productivity of the unconventional gas resource base.

- **Improved geologic knowledge continues to expand its size and add new gas plays.**
- **Technology progress helps increase recovery from already defined plays.**

MAKING UNCONVENTIONAL GAS RESOURCE ESTIMATES IS DIFFICULT

Assessing the size and quality of unconventional gas is a challenge:

- **Does not lend itself to finding-rate models**
- **Does not follow rules of field size distribution or discovery process models**
- **Requires prudent incorporation of "technology progress" for drilling efficiencies, well costs and reserves per well**
- **Requires considerable data, acceptance of geologic variability, and numerous "expert judgment" calls.**

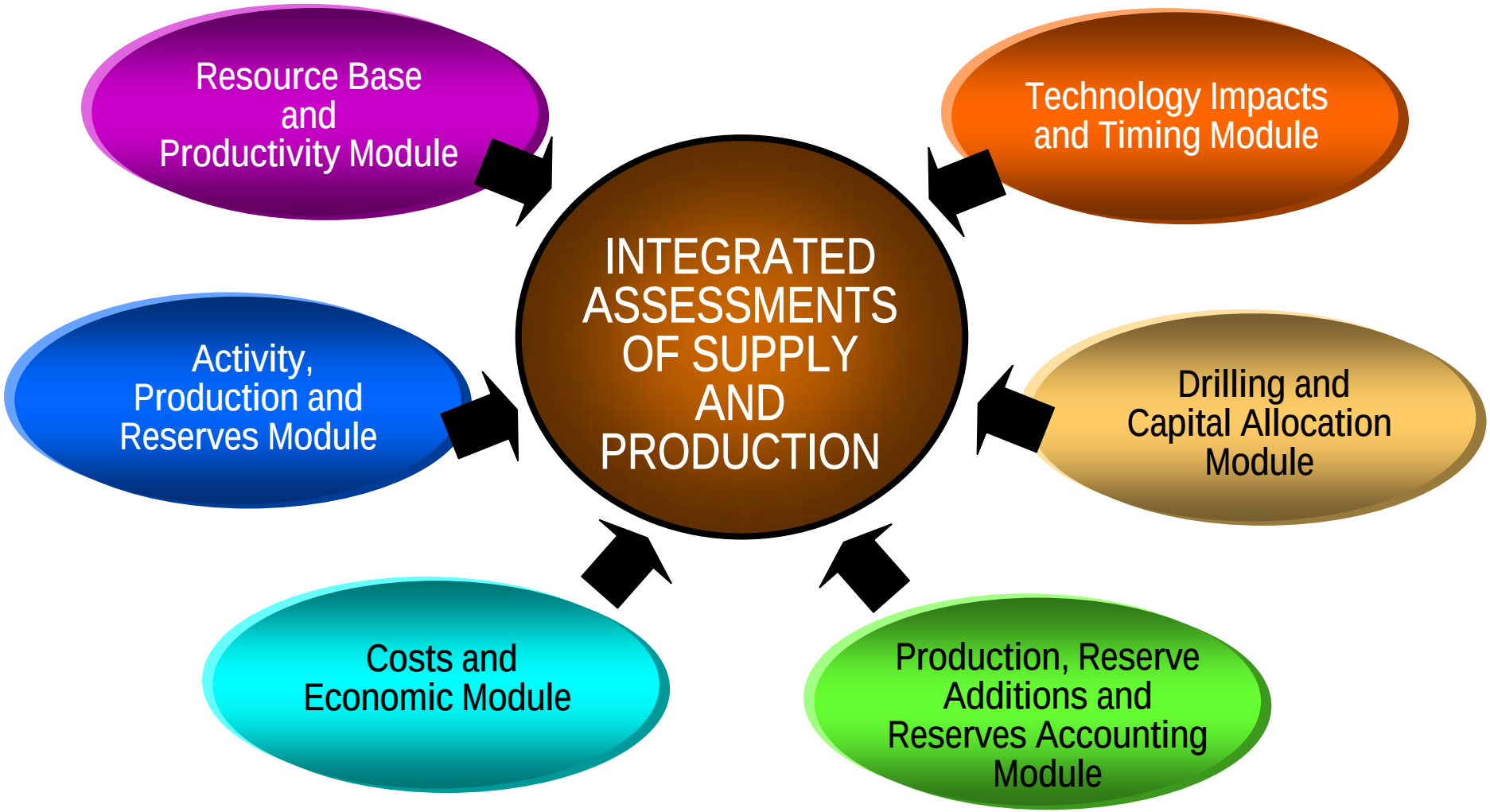
THE OUTLOOK FOR UNCONVENTIONAL GAS PLAYS CAN CHANGE RAPIDLY

Unconventional gas plays require frequent assessments.

- **Some plays, where resource depletion exceeds technology progress, are in decline (e.g., San Juan, Mesaverde tight gas).**
- **Some plays, where technology progress exceeds resource depletion, are improving in performance and size, (e.g., Piceance Basin, Mesaverde tight gas).**
- **The plays are prone to rapid and large changes in outlook, performance and costs (e.g., Barnett/Fayetteville gas shales).**

Resource estimates for emerging, "high risk-high potential" unconventional gas plays need to be updated every two to three years, <u>not once a decade</u>.

THE ADVANCED RESOURCES' UNCONVENTIONAL GAS SUPPLY AND TECHNOLOGY MODEL (MUGS)



Note: Tracks performance of 84 major unconventional gas plays.

TECHNICALLY RECOVERABLE UNCONVENTIONAL GAS RESOURCES (U.S. Lower-48)

Advanced Resources' assessments of major unconventional gas basins and plays show twice as much tight gas sands resource and somewhat more CBM and gas shales resource than the NPC or the USGS.

	Advanced Resources (2004)		National Petroleum Council (2003) (Tcf)	U.S. Geological Survey (1995-2003) (Tcf)
	Proved Reserves (Tcf)	Undeveloped Reserves (Tcf)		
Tight Gas Sands	61	341	175	186
Coalbed Methane	19	83	58	68
Gas Shales	8	77	35	71
TOTAL	88	501	268	325

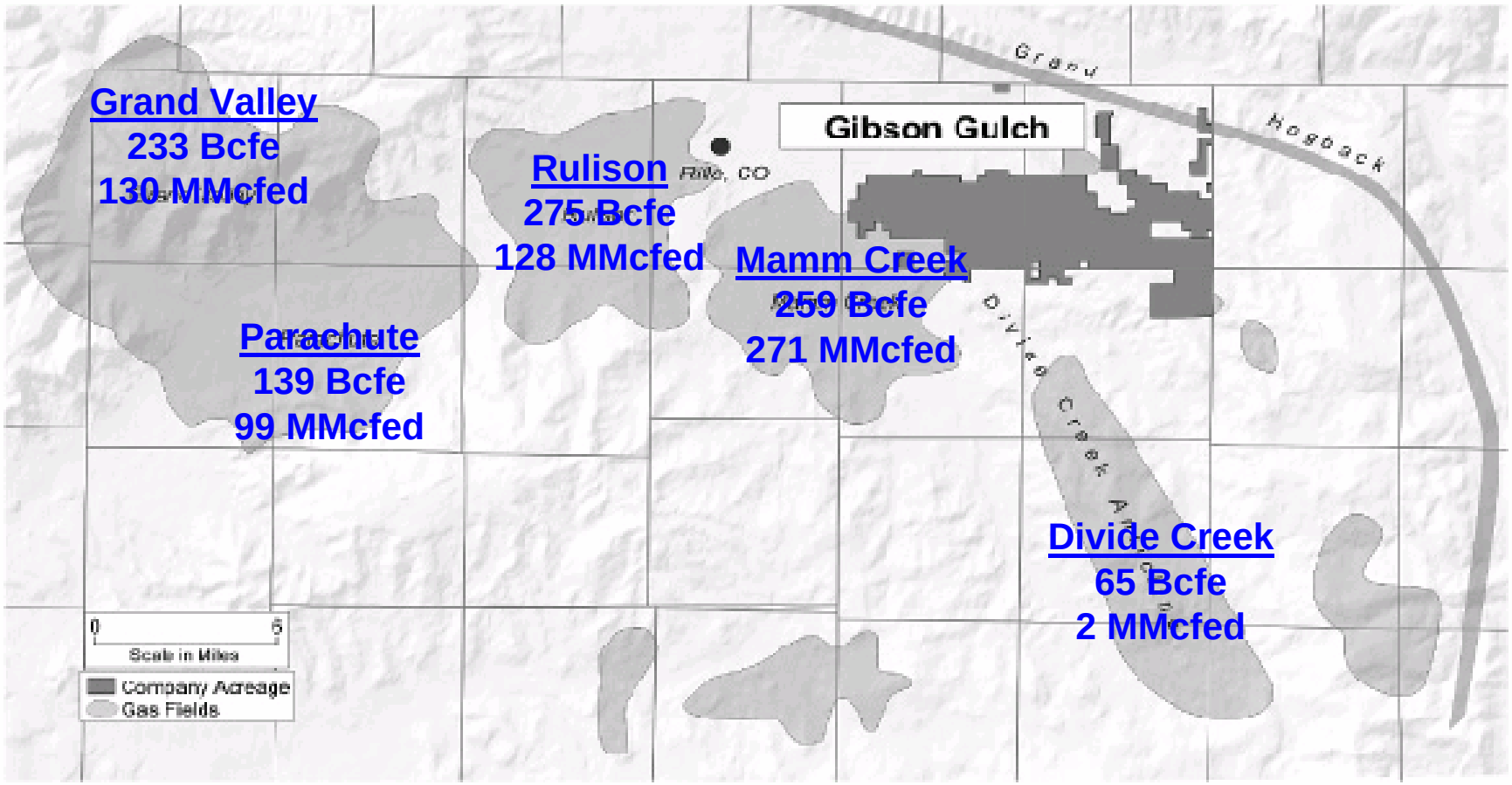
TECHNICALLY RECOVERABLE UNDEVELOPED UNCONVENTIONAL GAS RESOURCES (U.S. Lower-48)

A significant portion of the unconventional gas reserve and resource is in the Rocky Mountain basins. However, the Gulf Coast and East/Central Texas area, with the Barnett Shale and Bossier tight gas sand plays, has been the fastest growing.

Basins/Areas		Tight Gas Sands (Tcf)	Coalbed Methane (Tcf)	Gas Shales (Tcf)	Total (Tcf)
1	Rocky Mountain	191	63	12	266
2	Gulf Coast/E&C Texas	60	5	39	104
3	Mid-Continent	17	6	-	23
4	Southwest	9	1	-	10
5	Other	64	8	26	98
	Total	341	83	77	501

WHY DO RESOURCE ESTIMATES FOR UNCONVENTIONAL GAS DIFFER?

The Williams Fork/Mesaverde tight gas play in the southern Piceance Basin serves as a "case study" to illustrate why unconventional gas resource assessments differ.



Source: Petrie Parkman & Co./Bill Barrett Corporation

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WHY UNCONVENTIONAL GAS RESOURCE ESTIMATES DIFFER!

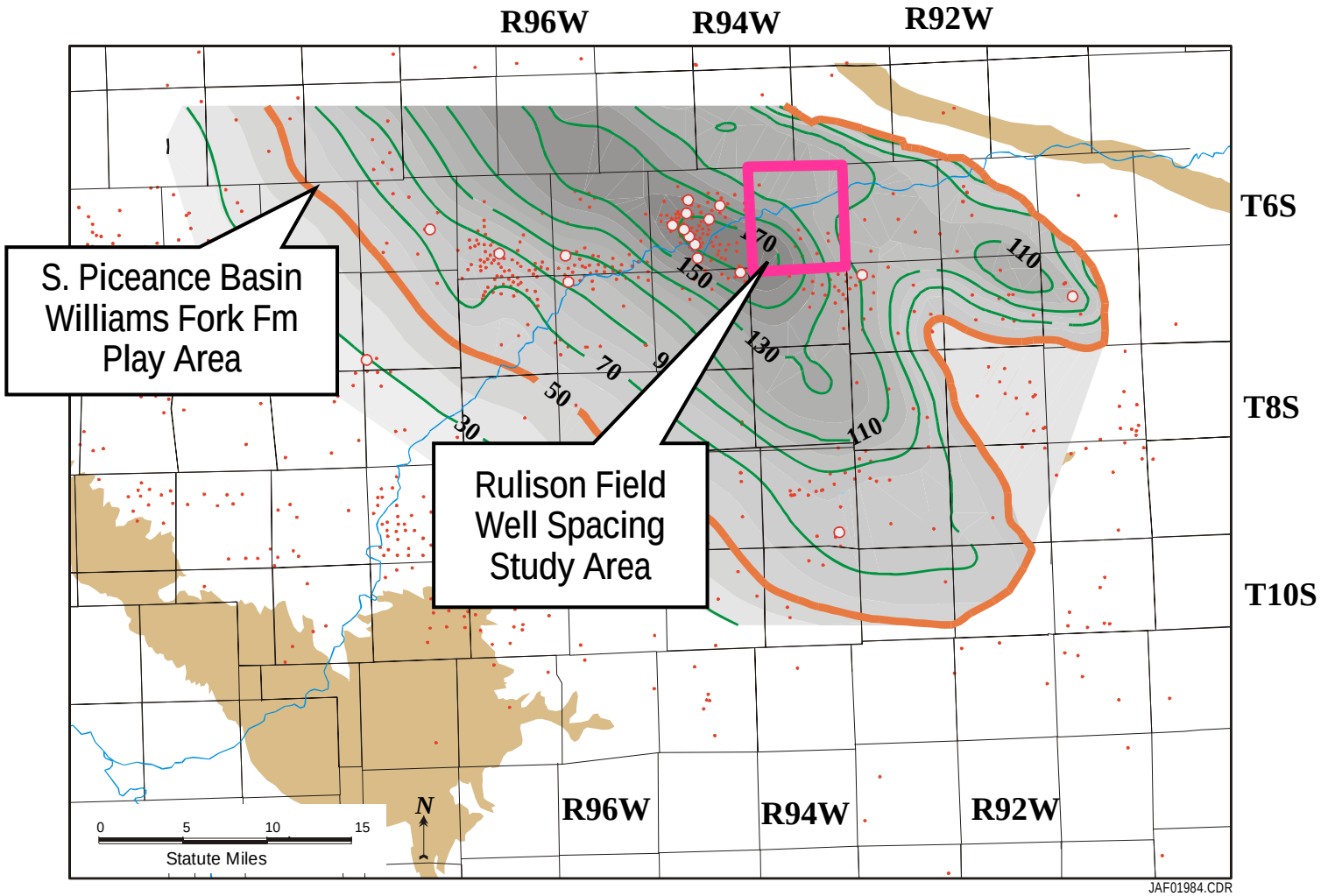
Given their "continuous" nature, the size of an unconventional gas play (recoverable resource) is determined by: (1) play area; (2) well spacing; (3) well performance; and, (4) expectations for success.

The Williams Fork (Mesaverde) tight gas play illustrates how moderate differences in assumptions can lead to widely different estimates.

	U.S. Geologic Survey (2003)	Advanced Resources S. Basin Only (2004)
ASSUMPTIONS		
Play Area (mi^2)	1,989	1,008
Developed (%)	3%	4%
Well Spacing (acres/well)	73	20
EUR/Well (Bcf)	0.91	1.21
Success/Availability Factors (%)	20%	83%
RESULTS		
Recoverable Resource (Tcf)	3.1	31.3

GAS IN PLACE AND BASIN /PLAY AREA

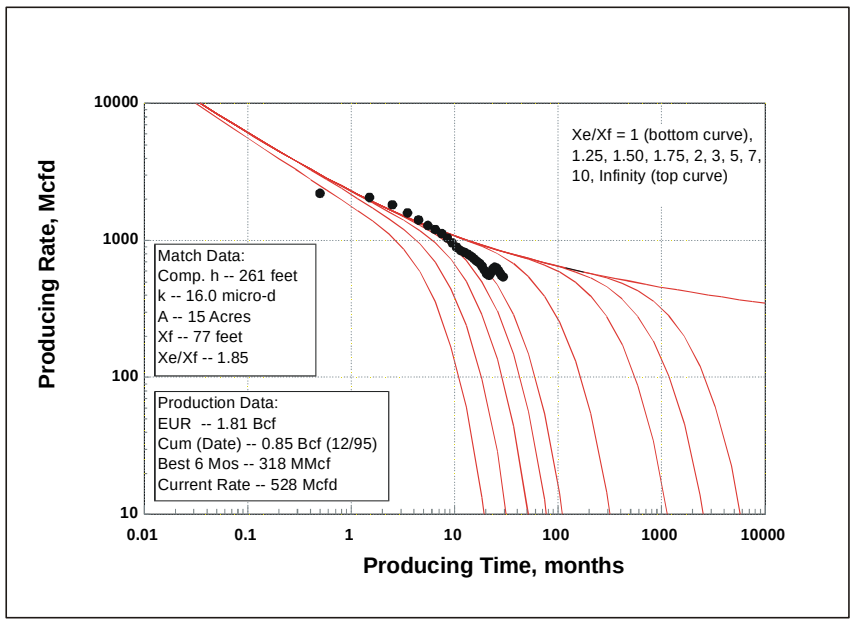
Twenty eight townships (1,008 square miles) exist within the 50+ Bcf per section gas in-place contour for Williams Fork/Mesaverde gas play. The gas in-place is estimated at 100 Tcf inside this contour area.



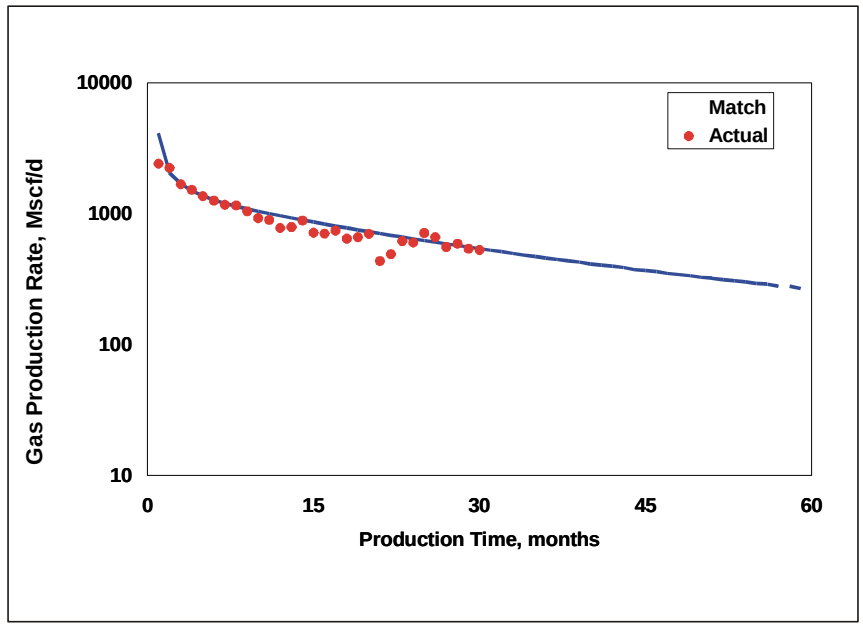
Gas In-Place (Bcf per Section), Williams Fork/Mesaverde, Southern Piceance Basin.

WELL DRAINAGE AND SPACING

Estimates of well drainage (and ultimate well spacing) can be developed from type-curve matching of early time production data once key reservoir properties are established.



RMV 58-20 Log-Log Type Curve Plot.



RMV 58-20 Semilog Type Curve Match.

DEVELOPING UNCONVENTIONAL GAS RESOURCES

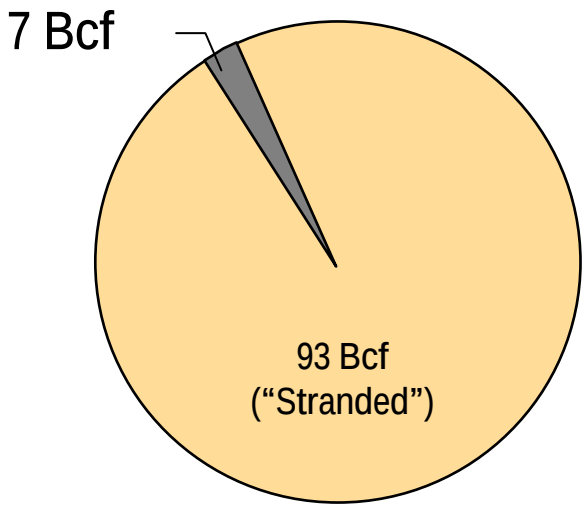
Rulison Field Case Study: Piceance Basin, Colorado

Traditional Practices

80 Acres/Well Spacing

8 Wells/Section, with Old Technology (0.9 Bcf/well)

7% Recovery of GIP



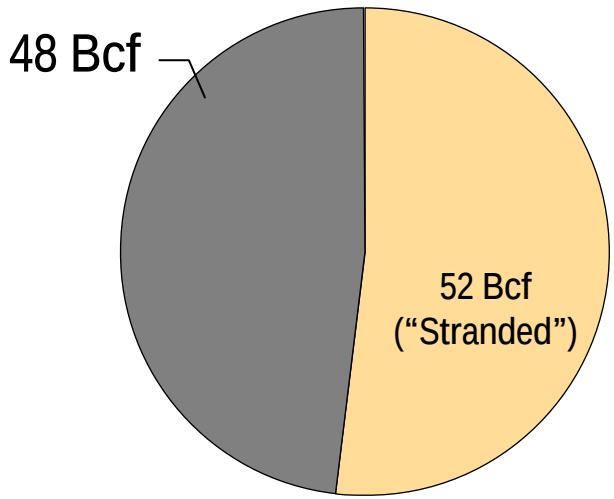
100 Bcf of GIP

Intensive Development

20 Acres/Well Spacing

32 Wells/Section, with New Technology (1.5 Bcf/well)

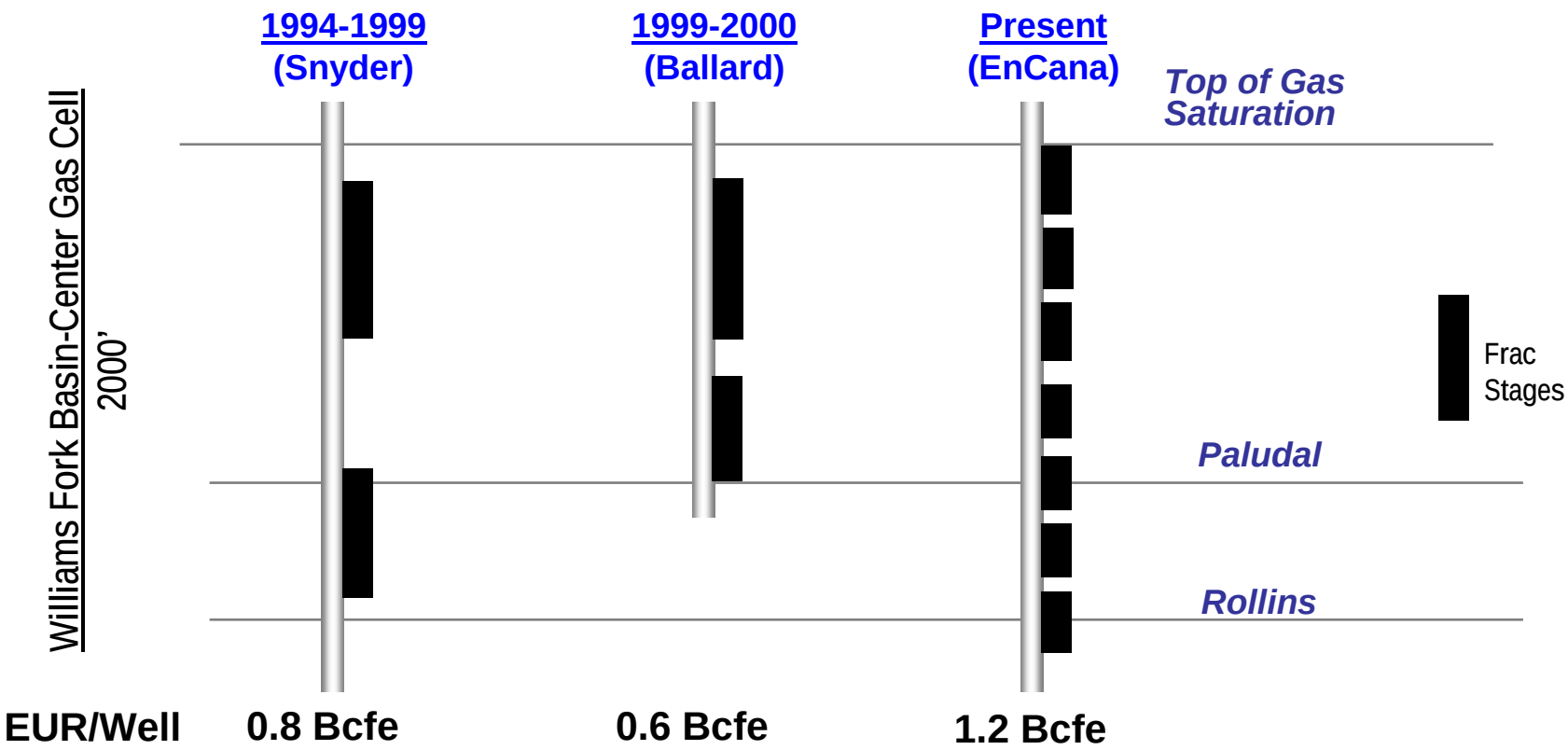
48% Recovery of GIP



100 Bcf of GIP

Source: Modified from Williams, 2003

TECHNOLOGY PROGRESS AND IMPROVED WELL PERFORMANCE (MAMM CREEK)



Modified by Advanced Resources from EnCana, 2005

WHERE ARE THE NEW UNCONVENTIONAL GAS PLAYS?

Gas Shales. Gas shales are currently the "hot new play." In addition to dramatic growth of the Barnett Shale, Fort Worth Basin, new plays include:

- Fayetteville (Caney), Arkoma Basin
- Woodford, Arkoma/Anadarko Basin
- Mississippian/Devonian, Palo Duro Basin
- Barnett, Permian Basin

Tight Gas Sands. In addition to continued growth in the Rocky Mountains, expanding tight gas plays include:

- Cotton Valley/Bossier, East Texas Basin/North LA
- Red Fork/Cherokee/Atoka, Anadarko Basin

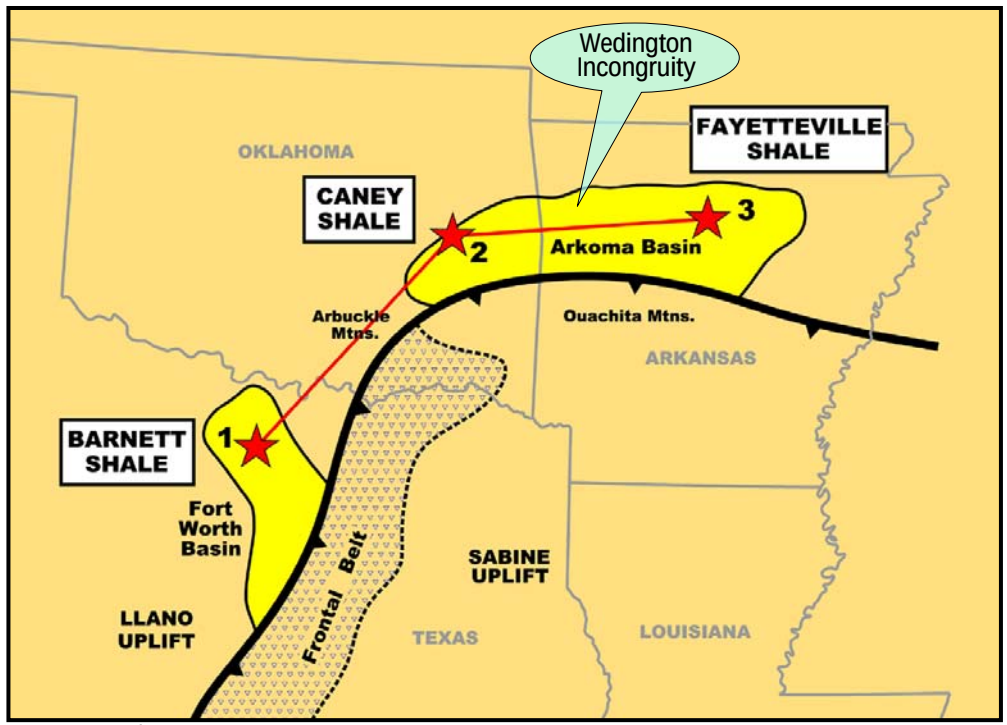
Coalbed Methane. While Powder River and San Juan basins still dominate, new CBM plays include:

- Mid-Continent, Arkoma/Cherokee Basins
- Atlantic Rim, Greater Green River Basin

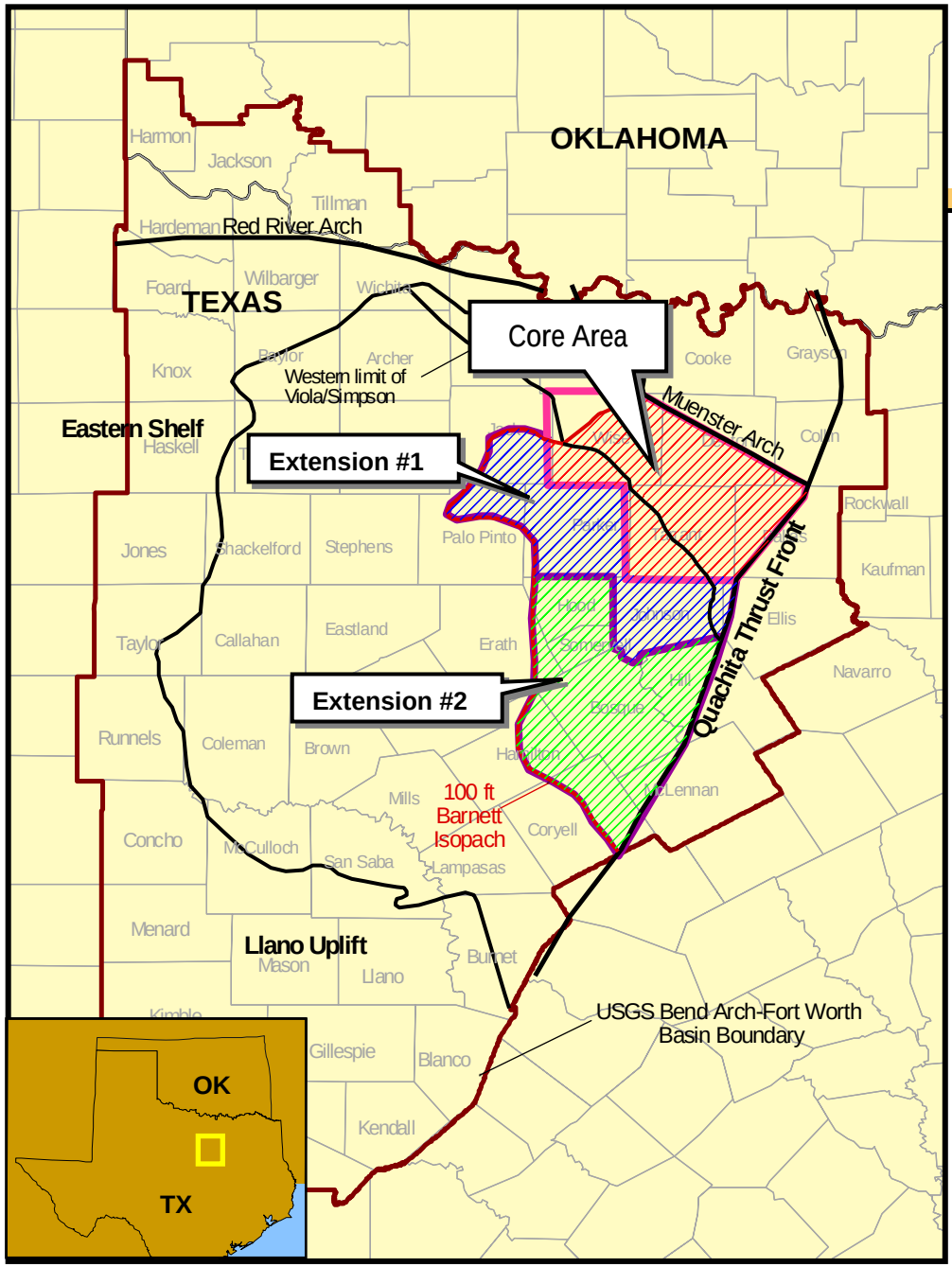
FAYETTEVILLE SHALE, ARKOMA BASIN

1. **Recently announced Arkoma Basin Mississippian-age gas shale accumulation.**
2. **Southwestern Energy, the dominant producer in the play, has drilled, completed and placed on production 54wells (end of 2005) including 13 horizontal wells. Average IP for first 13 horizontal wells is 2.5 MMcfd.**
3. **Numerous other companies (e.g., Chesapeake, XTO) have established large acreage positions in this play.**

Fayetteville (Mississippian-age) Shale Deposition



Source: Southwest Energy, 2005

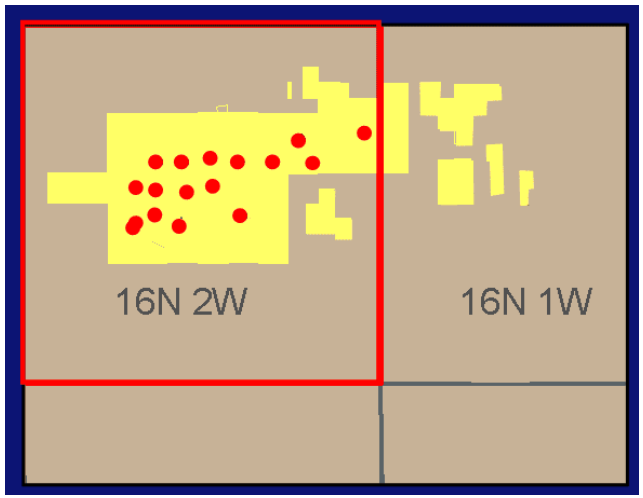


BARNETT SHALE, FORT WORTH BASIN

- **Assessments of "technically recoverable" resources have grown steadily:**
  - **3 Tcf (USGS, 1996)**
  - **26 Tcf (USGS, 2004)**
  - **39 Tcf (Advanced Resources, 2005)**
- **Reserves per well in "core" area have steadily improved**
- **Wells are being drilled on closer and "smarter" spacing**
- **Micro-seismic mapping providing insights on interactions of hydraulic fracturing with natural fracture systems and stress regimes**

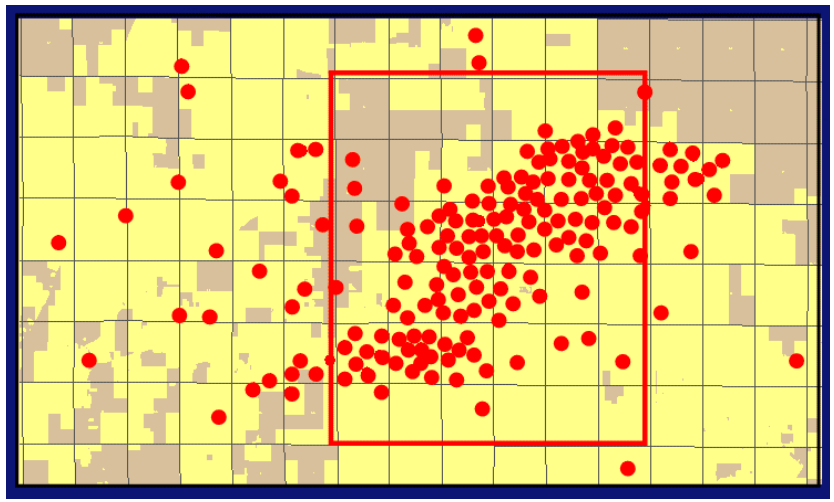
BOSSIER TIGHT GAS SAND DEVELOPMENT (NORTH LA / VERNON FIELD)

In less than five years, Anadarko has established the Bossier tight gas sand play in N. Louisiana as a major "success story".



Before (January 2000)

- **17 Wells**
- **7,400 Net Acres**
- **8 MMcf/d (Gross)**
- **6 MMcf/d (Net)**
- **50 Bcf EUR (Gross)**

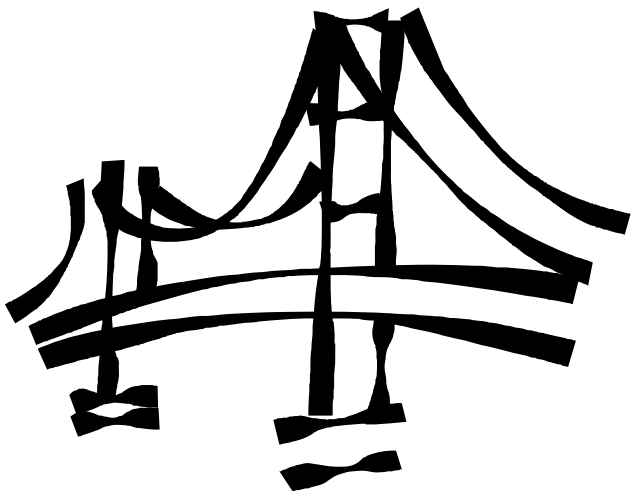


After (May 2004)

- **164 Wells**
- **116,000 Net Acres**
- **250 MMcf/d (Gross)**
- **180 MMcf/d (Net)**
- **1.4 Tcf EUR (Gross)**

Source: Anadarko, 2004

UNCONVENTIONAL NATURAL GAS: INDUSTRY SAVIOR OR BRIDGE?



For some companies, such as Anadarko, EnCana and Southwestern Energy, unconventional gas is more than a bridge, it is their future.

For other companies, such as ExxonMobil and Chevron, for whom this is not a core business, unconventional natural gas is "a bridge to nowhere".

The unconventional gas resource base is large (+500 Tcf). However, significant advances in E&P technology will be essential for converting this resource into economic reserves, thus building a "Golden Gate" type of bridge.

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