



Paradigm Shift in Domestic Natural Gas Resources, Supplies and Costs

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Unconventional Resources • Enhanced Recovery • Carbon Sequestration





Presentation Outline

- 1. Where Are We and How Did We Get Here?***
- 2. U.S. Natural Gas Resource Base**
- 3. Role of Technology**
- 4. What is the Outlook?***
- 5. Challenges and Barriers**

Where Are We?

From expectations of scarcity and statements that “we cannot drill our way out” of the looming natural gas supply problem, today:

- Gas storage is full and expected to reach record levels.
- We have a surplus of domestic natural gas production capacity.
- Gas prices (Henry Hub, spot) are down sharply from over \$10/Mcf a year ago to about \$3/Mcf today.
- The LNG terminals are mostly empty and the rig market has collapsed.

How Did We Get Here?

For many years, we were advised that shortages and high prices were the future of U.S. natural gas supply:

- Push for large-scale LNG (by Greenspan, Chairman of the Federal Reserve) to forestall shortages.
- Publication of “Diminishing Returns” (by CERA), projecting loss of natural gas production capacity, even at prices of \$10/Mcf.

“With visions of sugar plums dancing in their heads”,
industry invested massively in LNG and new drilling.

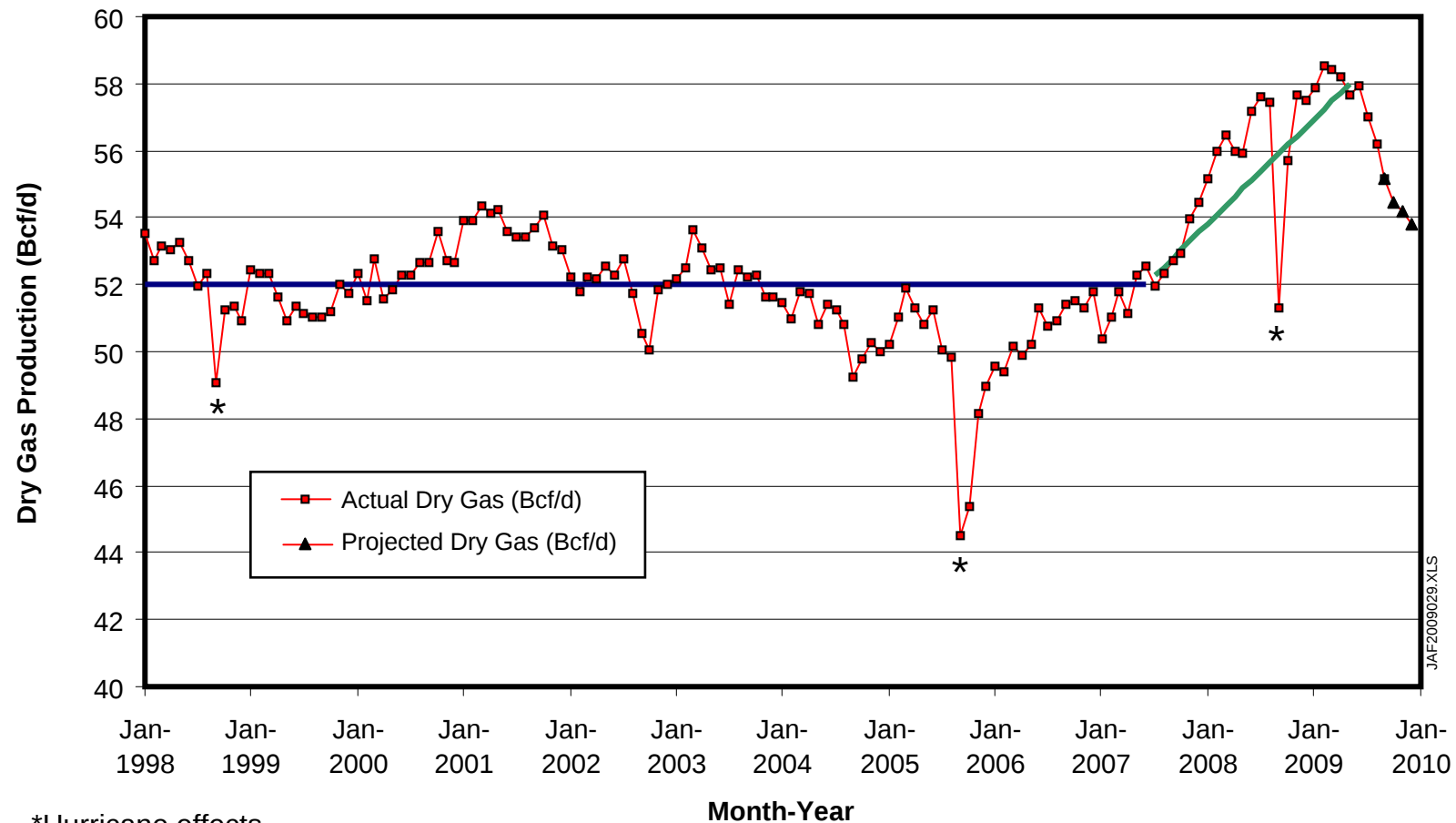
How Did We Get Here?

To better understand today's situation, we need to ask - -

“Why was this past advice so off-base?”

- Undue concentration on the challenges facing conventional gas supplies.
- Lack of understanding and acceptance of the potential offered by unconventional gas resources.
- Dismissal of the benefits from progress in technology.

After A Decade of “Running In Place”, Aggressive Pursuit of Unconventional Gas, Particularly Gas Shales, Has Led to Increased Production Capacity



Source: DOE-EIA Short Term Energy Outlook (August 2009)

U.S. Natural Gas Resource Base

Conventional Gas Resources. While the undiscovered conventional gas resource base is large, much of it is costly and difficult to access:

- Much of ***Onshore Conventional Gas Resource***, with 285 Tcf, is in small traps or on the margins of older fields, thus costly to develop.
- ***Offshore Conventional Gas Resources***, with 309 Tcf, has not been able to replace production or reserves for the past 7 years.
- Production of ***Associated Gas***, with 129 Tcf, has declined from 8 Bcfd (in 2001) to 5 Bcfd today, along with declines in oil production.
- ***The Alaskan Gas Resources***, with 169 Tcf, remains locked in place.

Offshore (GOM) Natural Gas Resources

Offshore GOM conventional natural gas reserves have declined by half and production has fallen by 6 Bcfd, since 2001.

Proved Reserves (Tcf)			
	Shallow Water	Deep Water	TOTAL
Base Year			
2001	15.9	11.3	27.1
Recent Years			
2005	9.4	8.0	17.4
2006	8.2	6.7	14.9
2007	7.5	6.5	14.0

Annual Production (Bcfd)			
	Shallow Water	Deep Water	TOTAL
Base Year			
2001	9.7	3.7	13.4
Recent Years			
2005	5.1	2.8	7.9
2006	4.5	3.0	7.5
2007	4.6	2.8	7.4

U.S. Natural Gas Resource Base

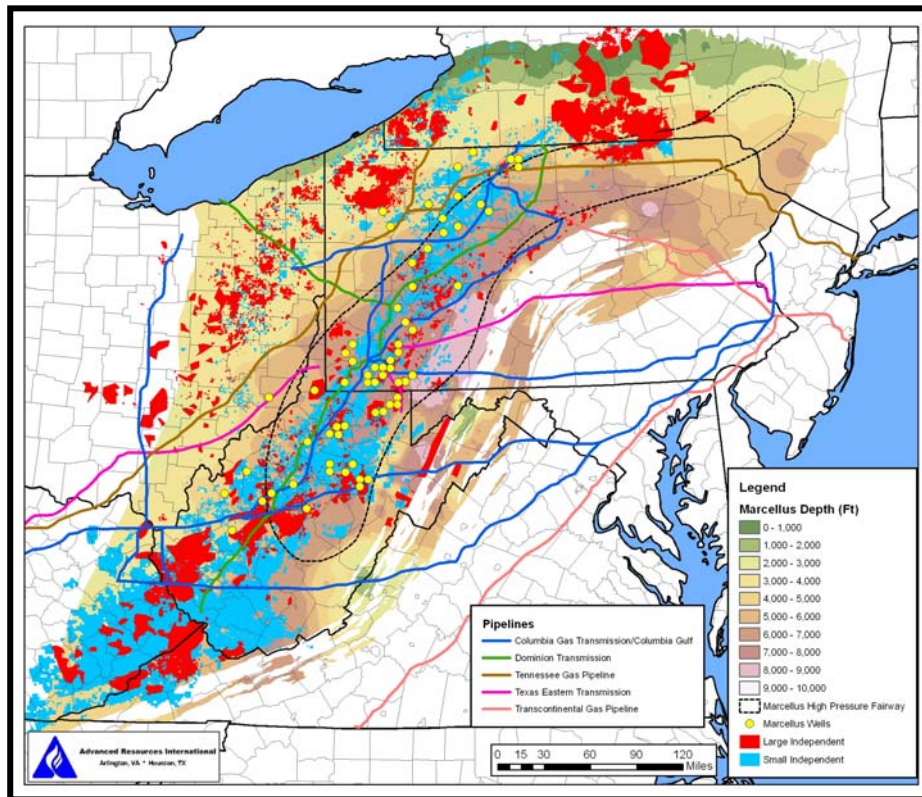
Unconventional Gas Resources. The large, commercial-scale pursuit of unconventional gas is behind a “paradigm shift” in U.S. natural gas supplies.

- Started twelve years ago, with low cost coalbed methane from the San Juan Basin and high productivity tight gas wells at Jonah/Pinedale (Green River Basin).
- Presentations by our firm, Advanced Resources, entitled “The Future is Unconventional”, heralded the start of this shift.
- Momentum provided by horizontal drilling and intensive stimulation technology that first unlocked the Barnett Shale and then did the same, but more quickly, for the Fayetteville Shale.
- The final push has been the emergence of numerous large, low-cost gas shale plays.

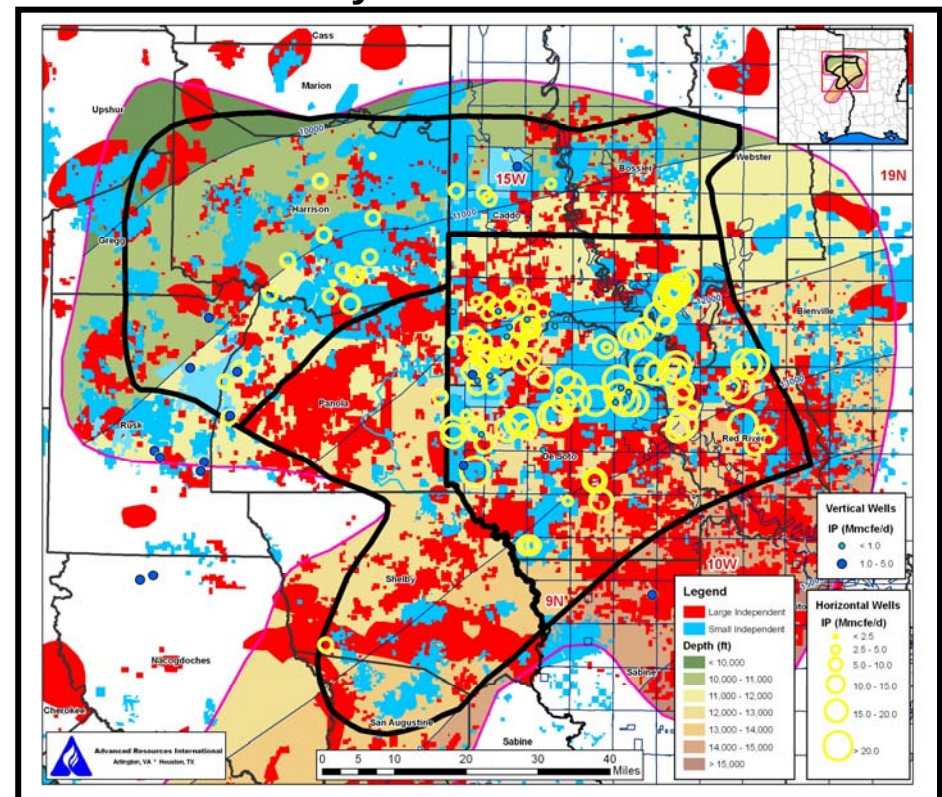
Paradigm Shift in U.S. Natural Gas Supplies

The Marcellus and Haynesville are two of the “rock star” shale basins behind the “paradigm shift” in U.S. natural gas supplies.

Marcellus Shale



Haynesville Shale



Evidence for the Paradigm Shift

Ten Of The Twelve Largest U.S. Lower-48 Natural Gas “Fields” Produce Unconventional Gas

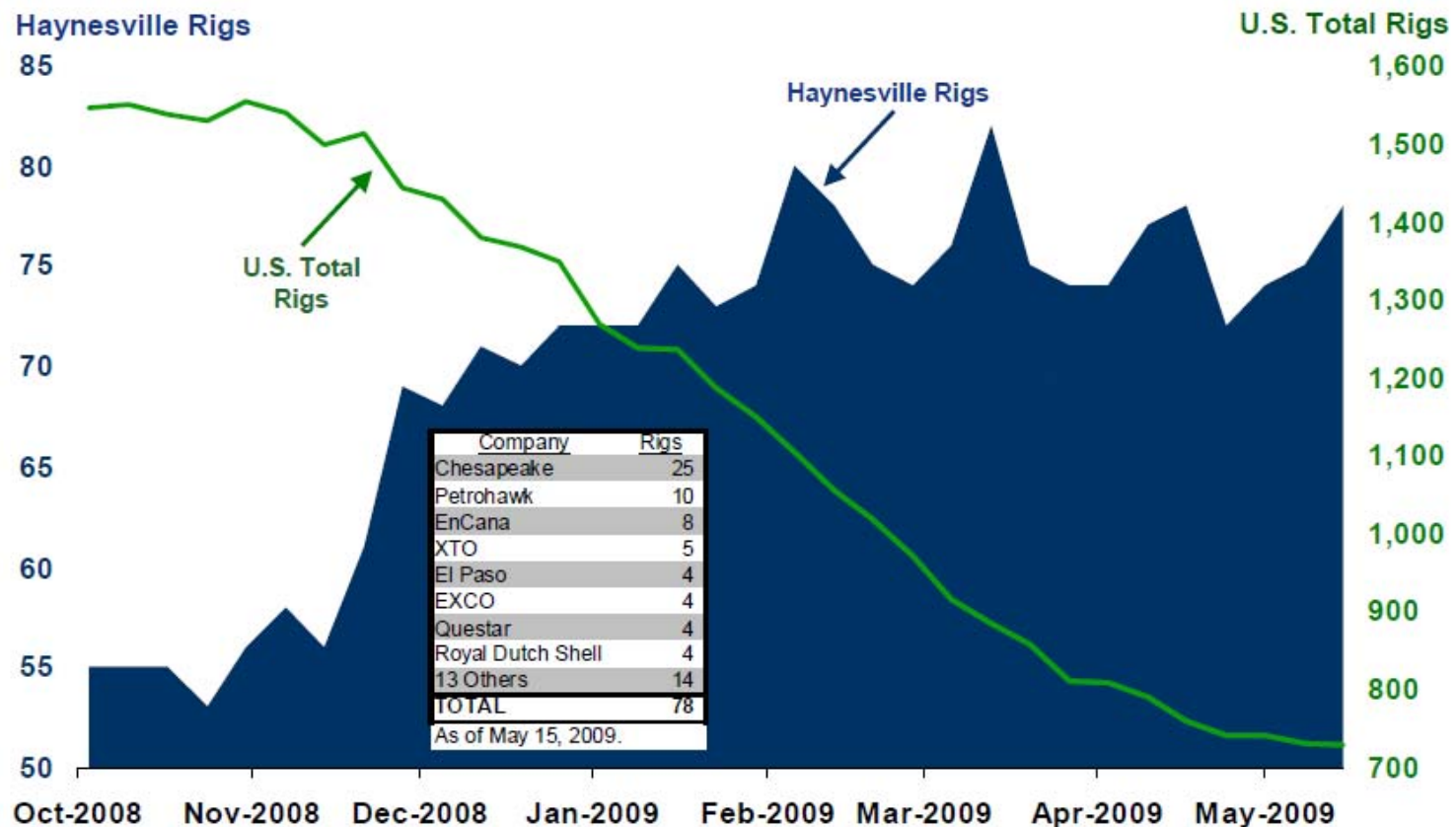
Rank	Field Name	Basin/State	Type of Resource	Year 2007 Production (Bcfd)
1	San Juan Basin Gas Area (Mesaverde/Fruitland)	San Juan, NM/CO	CBM/Tight Gas Sands	3.6
2	Newark East (Barnett)	Ft. Worth, TX	Gas Shale	3.0
3	Pinedale/Jonah (Lance)	GGRB, WY	Tight Gas Sands	1.9
4	Wyodak/Big George Fairway	Powder River, WY	CBM	1.2
5	S. Piceance Basin Gas Area (Mesaverde/Williams Fork)	Piceance, CO	Tight Gas Sands	1.1
6	Hugoton Gas Area	Hugoton Basin, OK	Conventional Gas	1.0
7	Freestone Trend (Shallow Bossier)*	East Texas, TX	Tight Gas Sands	0.7
8	Carthage (Cotton Valley)	East Texas, TX	Tight Gas Sands	0.6
9	Natural Buttes (Wasatch/MV)	Uinta, UT	Tight Gas Sands	0.5
10	Wattenberg	Denver, CO	Tight Gas Sands	0.5
11	Lower Mobile Bay	Offshore GOM	Conventional Gas	0.4
12	Savell/Amoruso (Deep Bossier)	East Texas, TX	Tight Gas Sands	0.4

*Includes Firestone, Bold Prairie, Bear Creek, Dowdy Ranch and Dew.

Sources: EIA 2005 and 2007 Annual Reserve Reports; Advanced Resources Unconventional Gas Data Base.

Evidence for the Paradigm Shift

While total working U.S. natural gas rigs have declined by more than half, the rig count in the Haynesville area has remained strong, pushing Haynesville Shale production over 1 Bcfd.

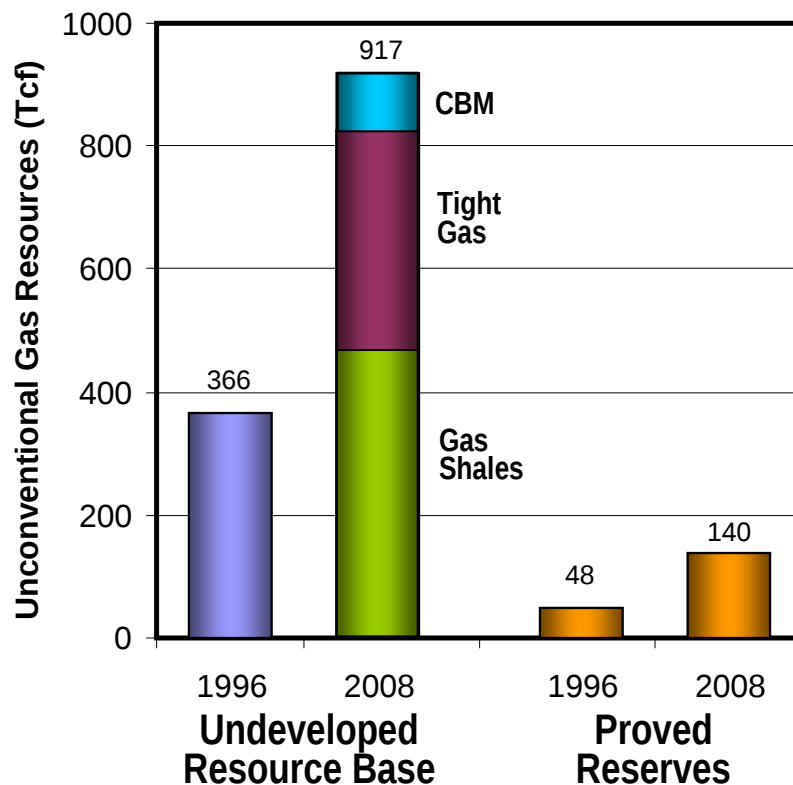


Source: EnCana, 2009

U.S. Natural Gas Resource Base

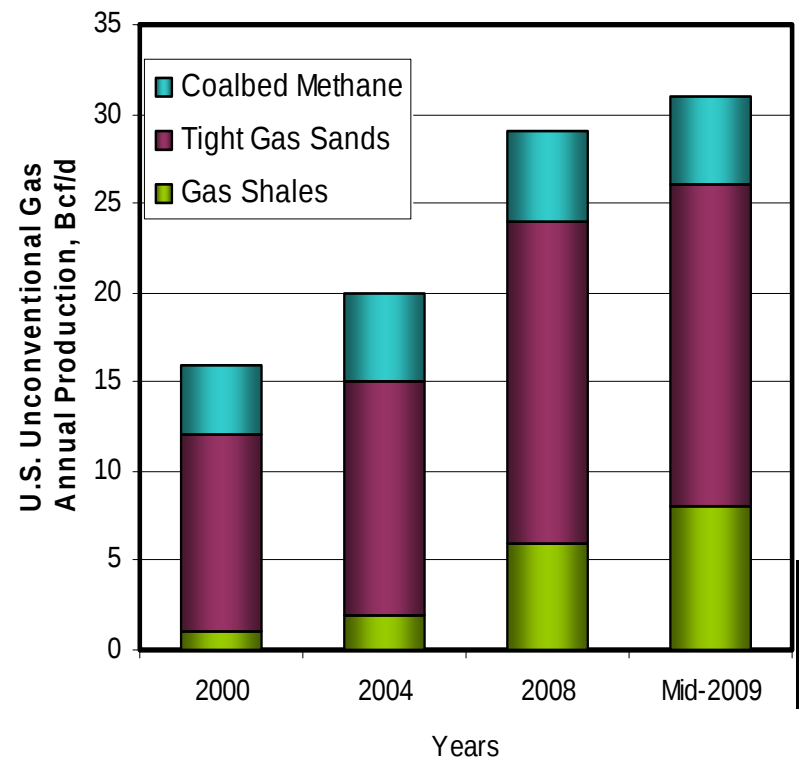
Driven by advances in geologic understanding and progress in extraction technology, the unconventional gas resources will increasingly dominate U.S natural gas production.

Unconventional Gas Resources



Source: Advanced Resources International

Unconventional Gas Production*



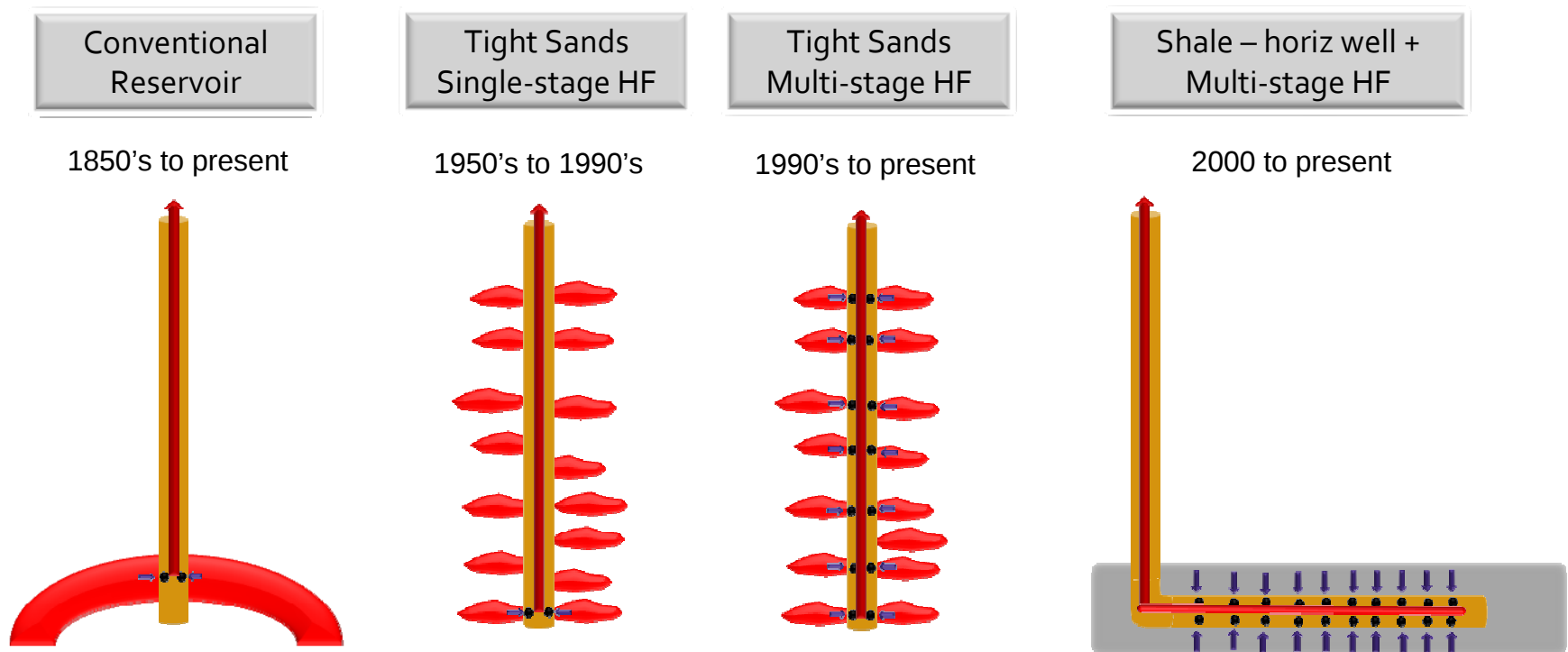
*Current U.S. natural gas consumption is about 62 Bcf.

The Powerful Role of Technology

Increased understanding of unconventional gas resources and advances in horizontal drilling and intensive well completion technology have been key:

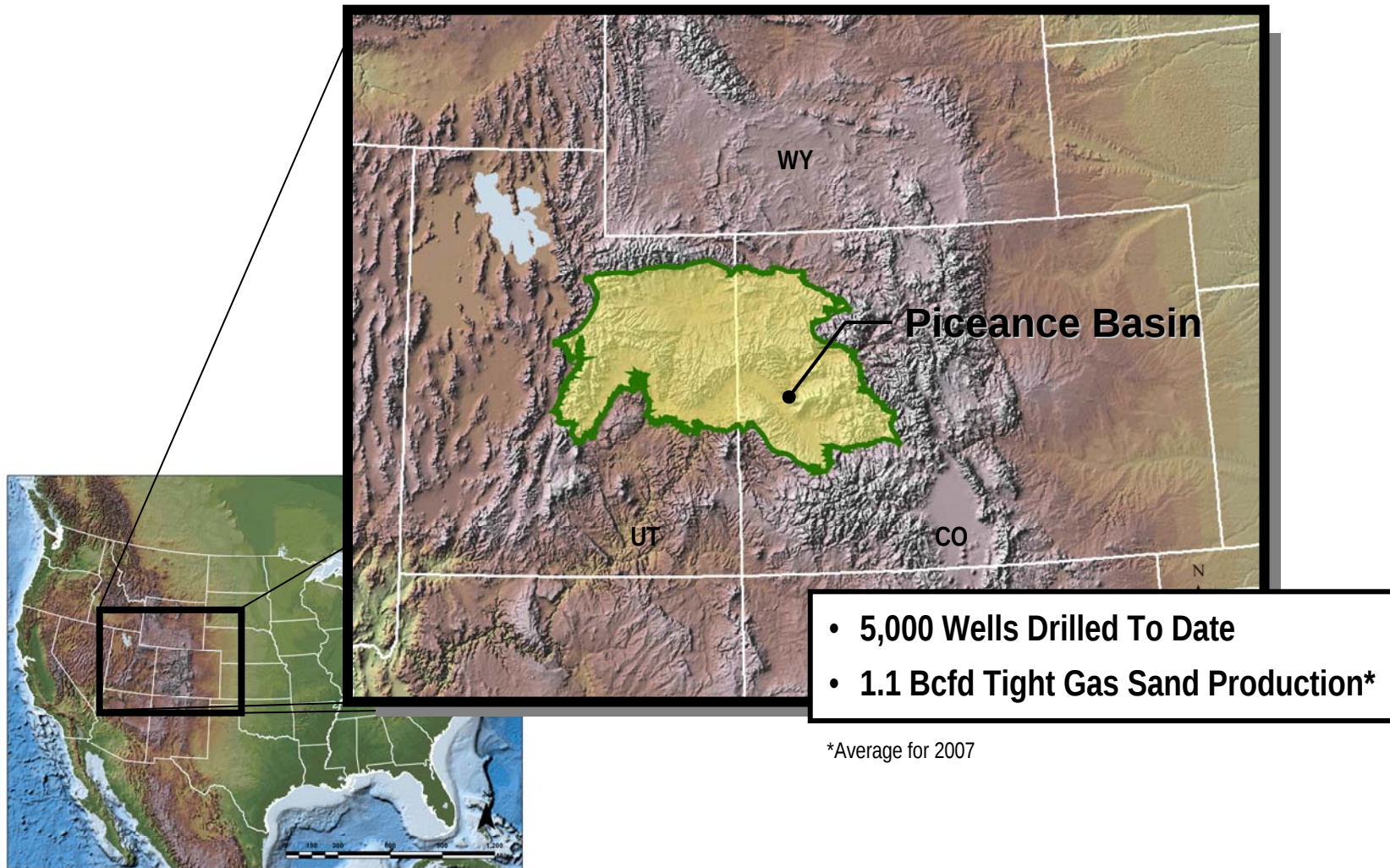
- Increased the size and productivity of recoverable resources.
- Provided predictability and lower risk.
- Converted these resources to low-cost assets.

Progress in Well Completion Technology



Source: Questar (2009)

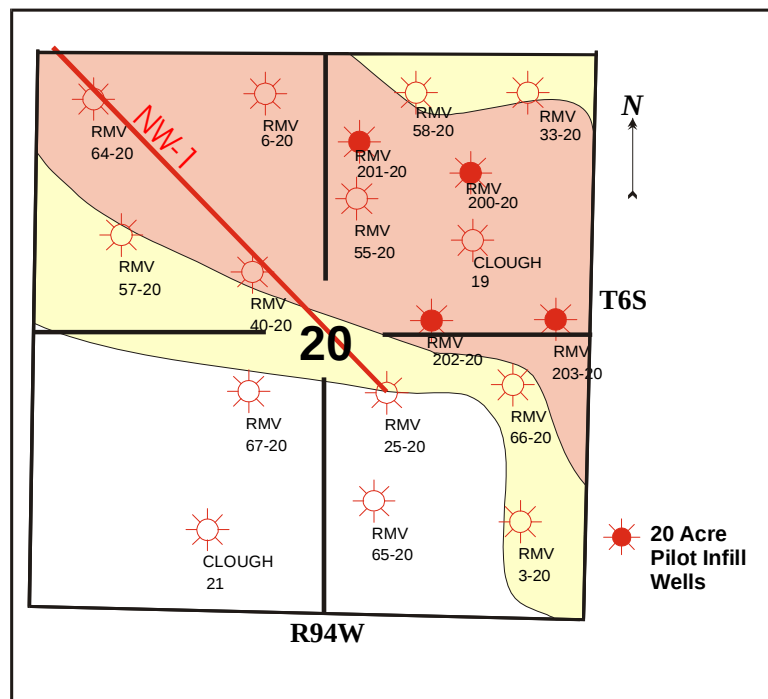
S. Piceance Basin: Williams Fork/Mesaverde Tight Gas Sand Play



Intensive Resource Development

Intensive resource development, at spacings of 10 acres/well, have transformed the modest (<3Tcf, USGS 2002) tight gas play in the Piceance Basin into a major 50 Tcf resource.

Intensive Field Development Pilot, Sec. 20, Rulison Field*



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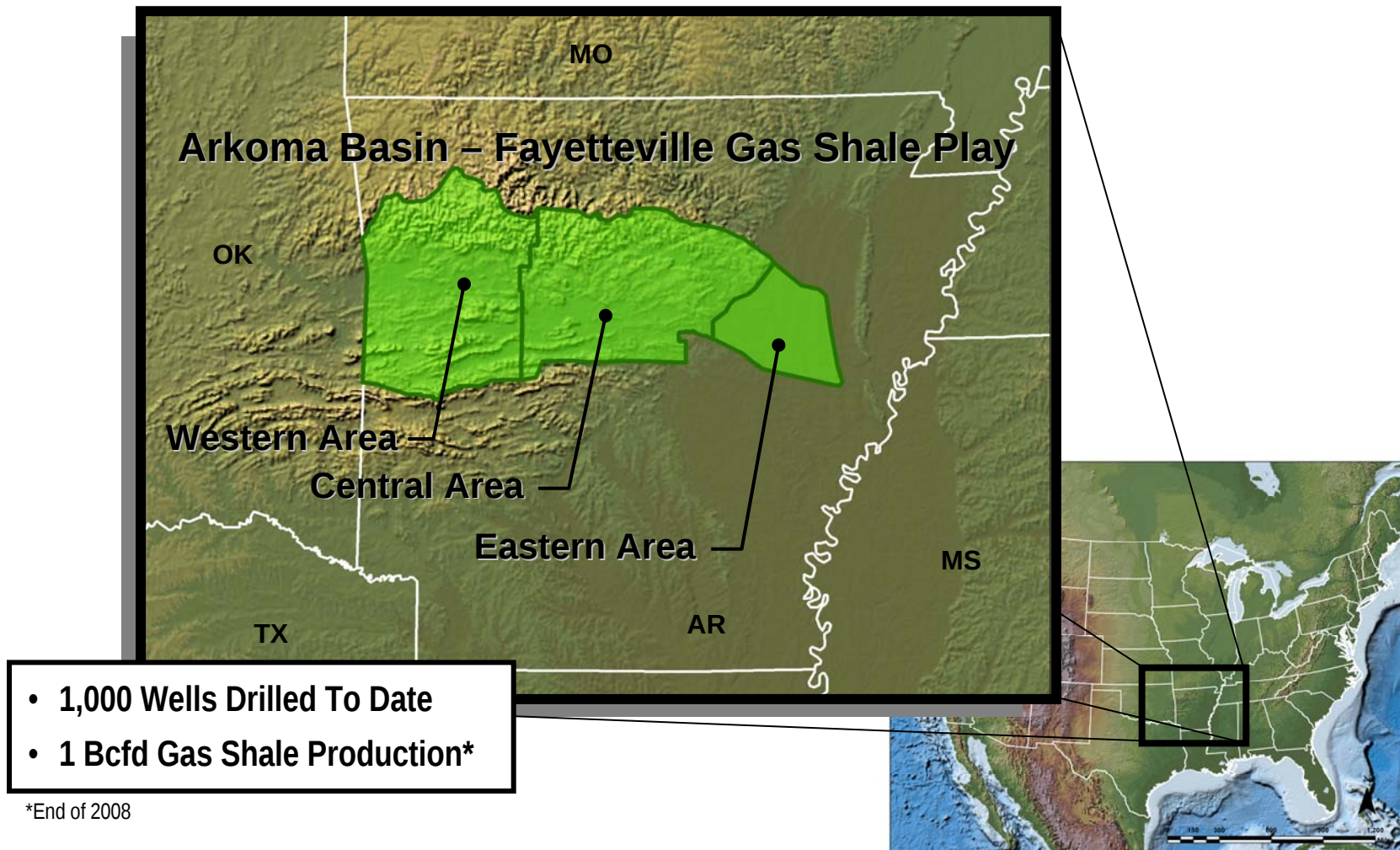
Expected Results from Intensive Resource Development (Sec. 20, T6S-R94W, Rulison)

Date	No. of Wells	Well Spacing (Acres/Well)	Avg. Recovery/ Well (Bcf)		EUR/ Section (Bcf)
			Cum. To Date	EUR	
Initial Wells	4	160 A/W	1.8	2.2	9
1995	4	80 A/W	1.7	2.2	9
1996-1998	8	40 A/W	1.2	1.6	13
1997-2000	16	20 A/W	1.1	1.6	25
Latest	32	10 A/W	0.6	1.7	54
Total	64		1.0	1.7	110



Advanced Resources
International, Inc.

Arkoma Basin: Fayetteville Gas Shale Play



Fayetteville Shale: Improving Well Performance

Longer laterals, more frac stages, and more intensive perforation clusters (plus 3-D seismic), have improved the performance of Fayetteville Shale wells by nearly three-fold in a period of just over 2 years.

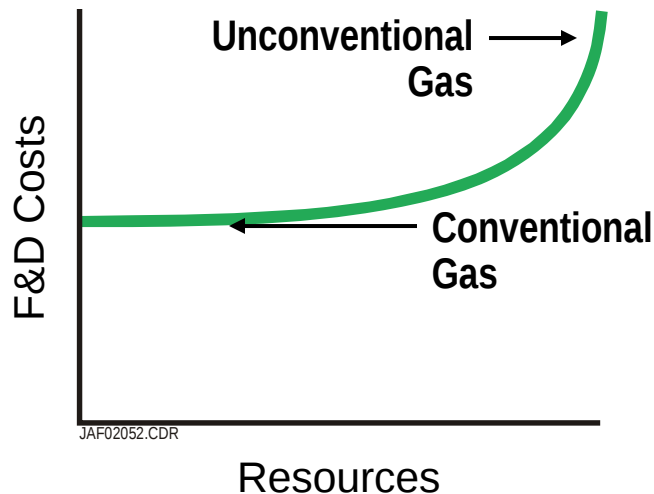
Time Frame	Wells on Production	Average IP Rate (Mcf/d)	30 th Day Rate	60 th Day Rate	Average Lateral Length
1 st Qtr 2007	58	1,260	1,070	960	2,100
2 nd /3 rd /4 th Qtr 2007	197	1,770	1,490	1,290	2,500-3,190
1 st Qtr 2008	75	2,340	2,150	1,940	3,300
2 nd /3 rd /4 th Qtr 2008	244	2,920	2,480	2,210	3,720
1 st Qtr 2009	120	2,990	2,540	2,310	3,870
2 nd Qtr 2009	111	3,610	2,950	2,690	4,120

What Is The Outlook?

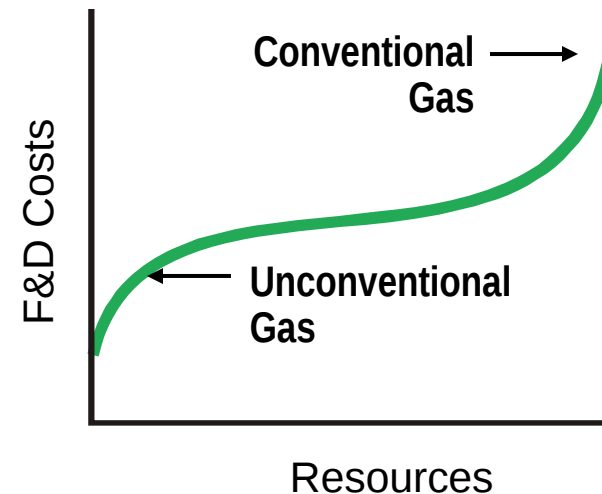
The Paradigm Shift. This “paradigm shift”, with vastly larger unconventional gas resources, is changing the long held belief that unconventional gas is the **high cost** portion of the resource base.

Unconventional gas and particularly gas shales are today the dominant source of supply and have become the **low cost** portion of the resource base.

Prior Perception

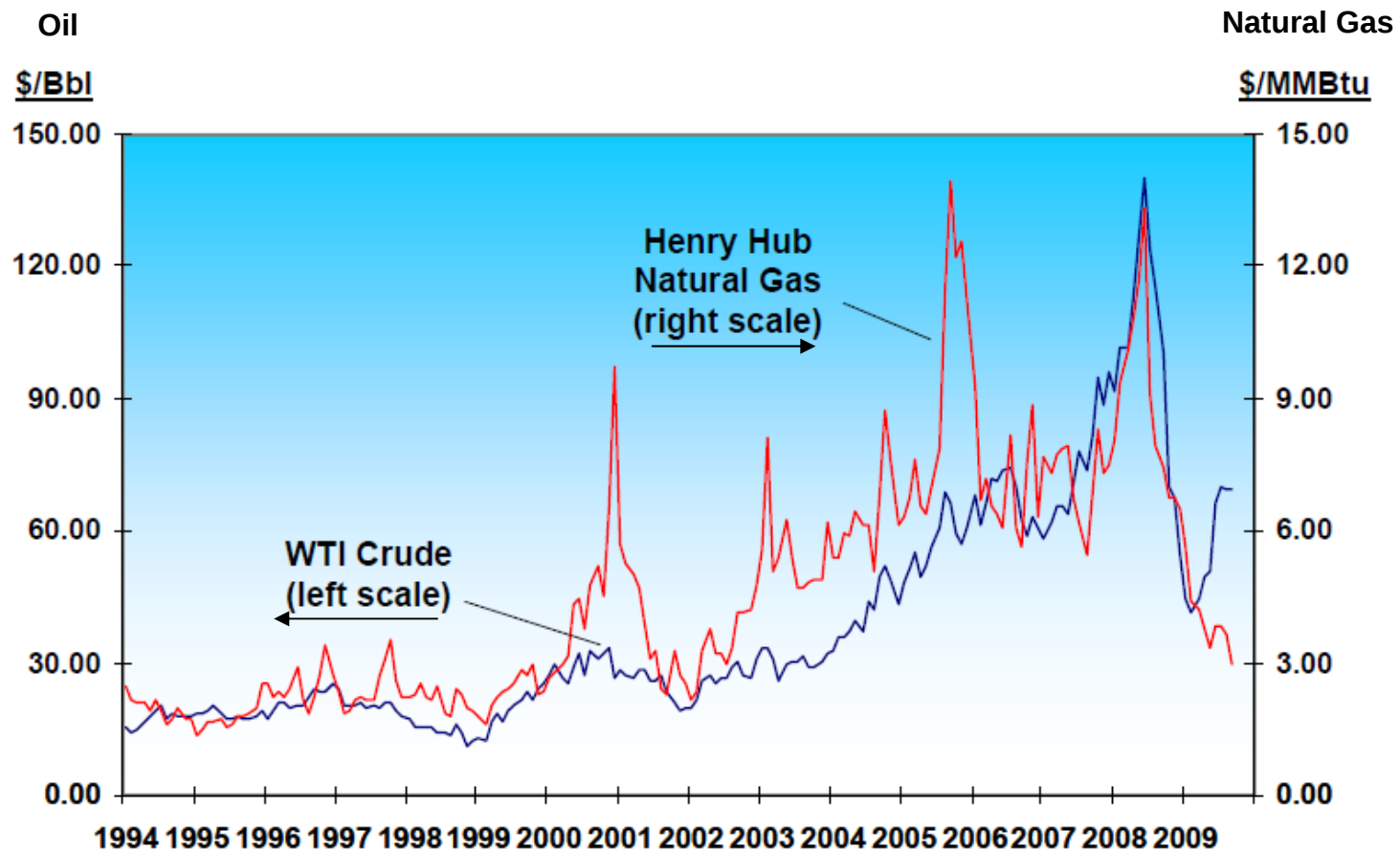


New Understanding



What is the Outlook?

Oil and Natural Gas Price Relationships. A fundamental disconnect exists today in the traditional 10 to 1 oil and natural gas price relationship.



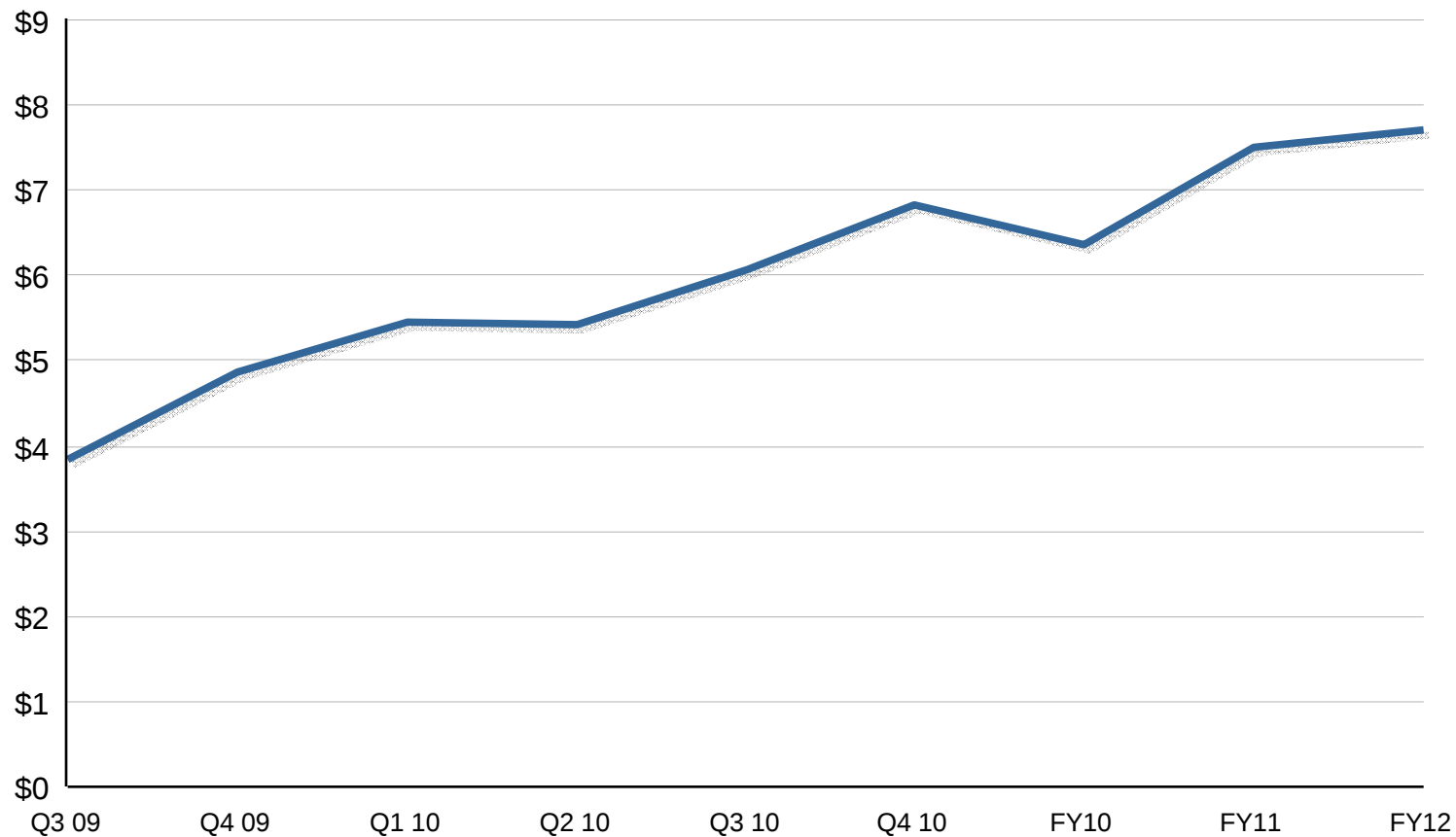
Source: Bloomberg

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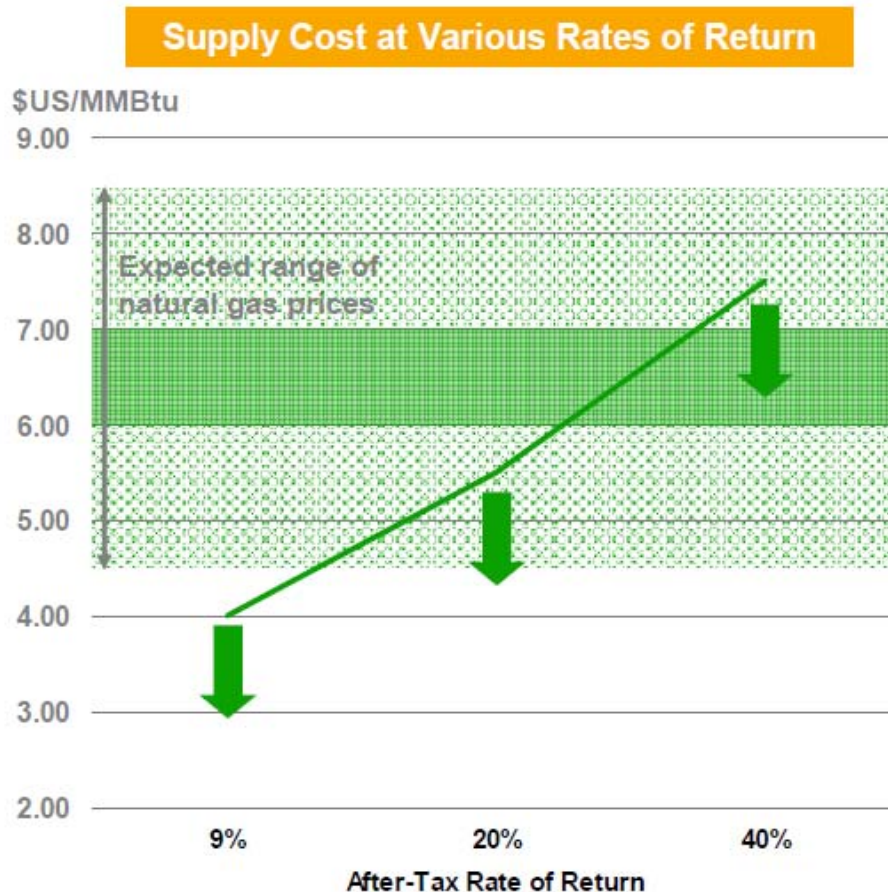
What is the Financial Outlook for Natural Gas Prices to Rebound?

NYMEX/Henry Hub Forward Price Curve (\$/Mcf)



Source: Bloomberg

What Is The Outlook?



Source: EnCana (2009)

Producer Expectations.

- EnCana, North America's largest natural gas producer, expects long-term natural gas supply costs of \$6 to \$7/MMBtu.
- Anadarko, the third largest U.S. natural gas producer, states that for its large Marcellus shale acreage "the economics are good" at \$3/Mcf (NYMEX) (Oil and Gas Investor, August, 2009).

Challenges and Barriers

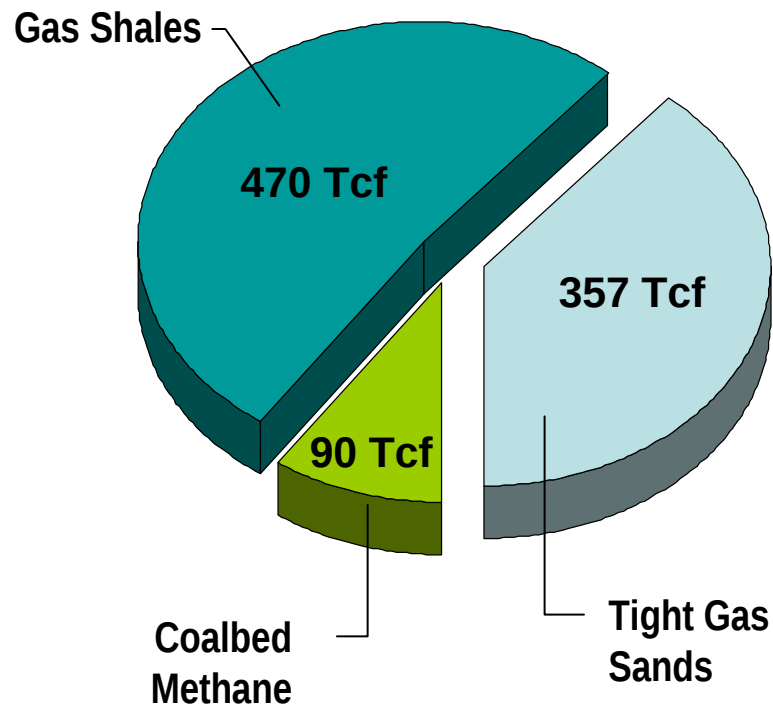
The domestic natural gas supply base is diverse and abundant - - with theoretically producible resources sufficient to meet 100 years of demand, at today's production levels.

However, a number of challenges need to be met before this theoretical potential can be converted to available and affordable natural gas production:

1. Build confidence in adequate and robust natural gas supplies.
2. Assure affordable future natural gas prices and underlying costs.
3. Address environmental barriers to natural gas development.
4. Increase demand for natural gas in a "carbon constrained" world.

However, Only a Portion of the Unconventional Gas Resource Base is “High Quality/Low Cost”

Continuing advances in science, geological knowledge and extraction technologies will be essential for converting the lower quality/higher cost resources to affordable natural gas supplies.



	Total Undeveloped	High Quality	Lower Quality
Gas Shales	470	209	261
Tight Gas Sands	357	173	184
Coalbed Methane	90	49	41
TOTAL	917	431	486

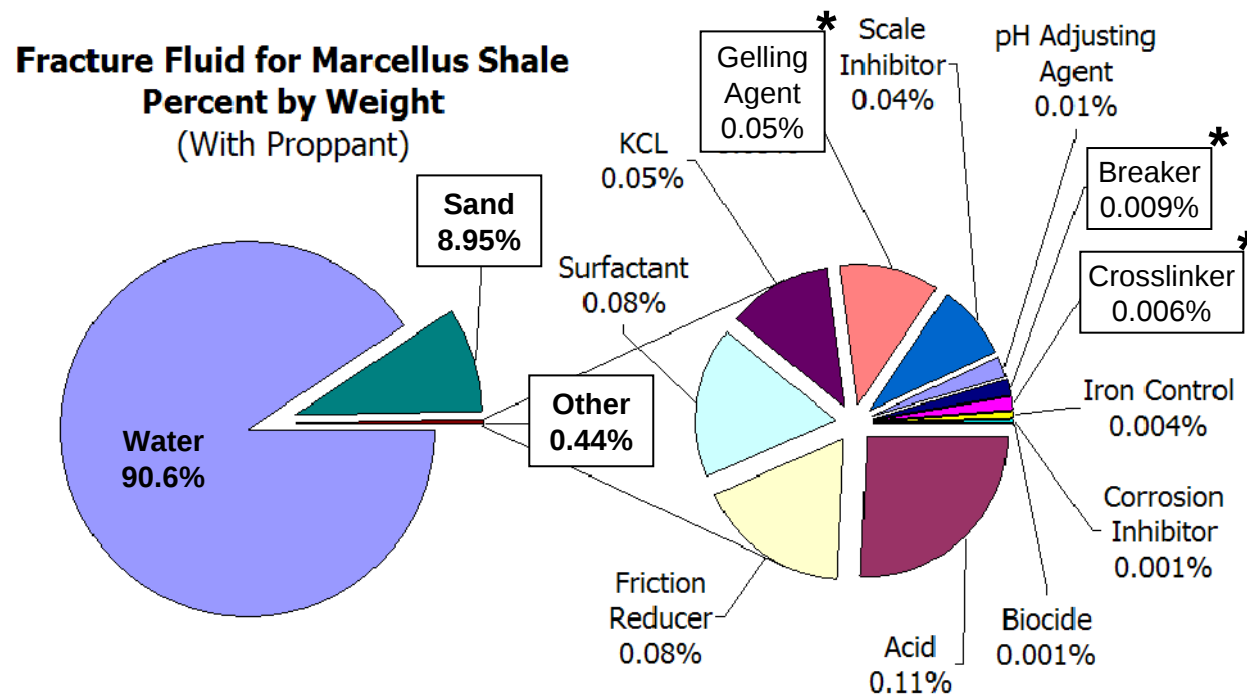
Source: Advanced Resources Int'l., 2009

Addressing the Environmental Barriers to Greater Natural Gas Development

As drilling increases and production grows, a harsher “spotlight” will fall on natural gas. “Green natural gas development” will help put a more environmentally friendly face on this activity.

- Capturing More Methane Emissions
- Further Reducing Surface Impacts
- Pursuing Safe Hydraulic Fracturing

Composition of Fluids, Chemicals and Materials in Hydraulic Fracturing Operations



Acids:

Hydrochloric or muriatic acids; commonly used in swimming pools.

KCl:

Food preservative; low sodium table salt.

Surfactants:

Used in shampoos, household detergents.

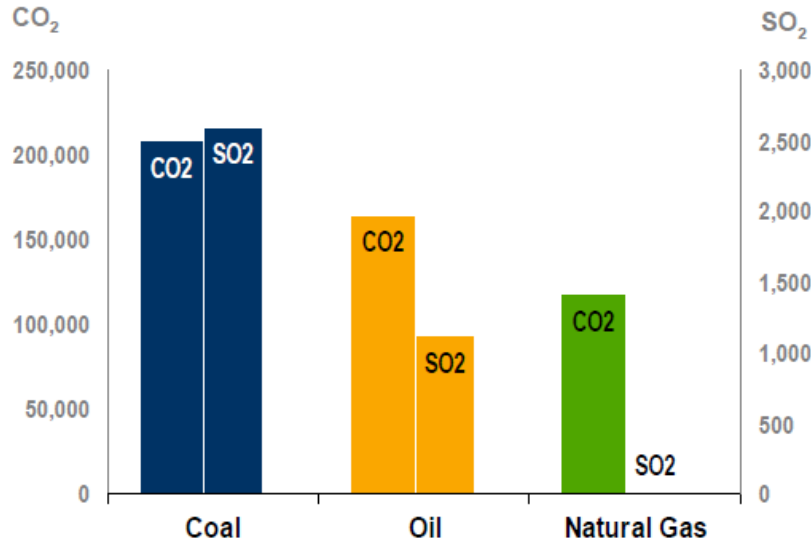
*Eliminated in many fracturing operations.

Source: Arthur, J. Daniel, et al., 2008.

Building Demand for Natural Gas in a Carbon Constrained World

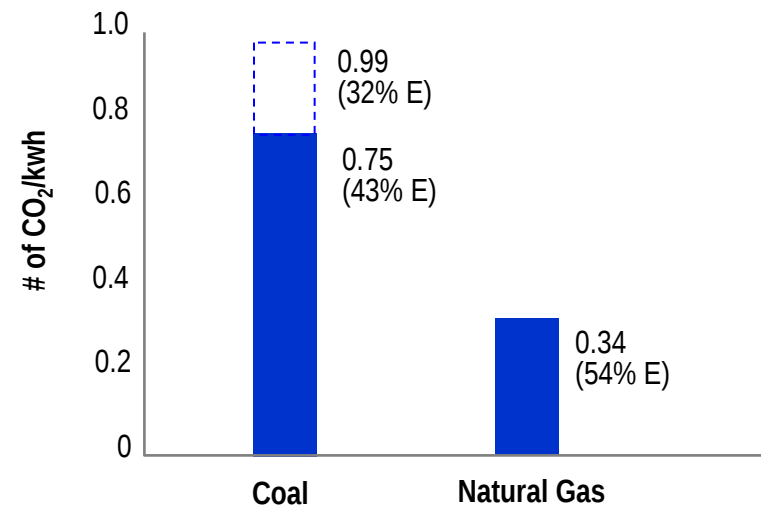
Natural gas is a relatively “clean fuel” with lower emissions of CO₂ and SO₂ than coal or oil. Still, producing and using natural gas contributes to overall emissions of greenhouse gases.

**CO₂/SO₂ Emissions Levels
by Fuel Type (lbs/BBtu)**



Source: EnCana 2009

**CO₂ Emissions Levels for
Electricity (lbs/kwh)**





Closing Comments

Numerous studies by financial houses have projected that we will soon return to the “glorious days to yesteryear”, with expectations of high natural gas prices and unmet demand.

These outlooks will prove to be overly optimistic because of the fundamental “paradigm shift” that has taken place in the size of the natural gas resource base and its fundamental costs.

It is time to discard our prior perceptions and rigorously incorporate new understandings of the size and costs as well as the challenges facing domestic natural gas supplies into our business plans.



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