

# Natural Gas Abundance: How Did We Get There and Where to From Here

Prepared for  
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## Table of Contents

1	Demand
2	Price
3	Supply
4	Implications for the Future

# Table of Contents

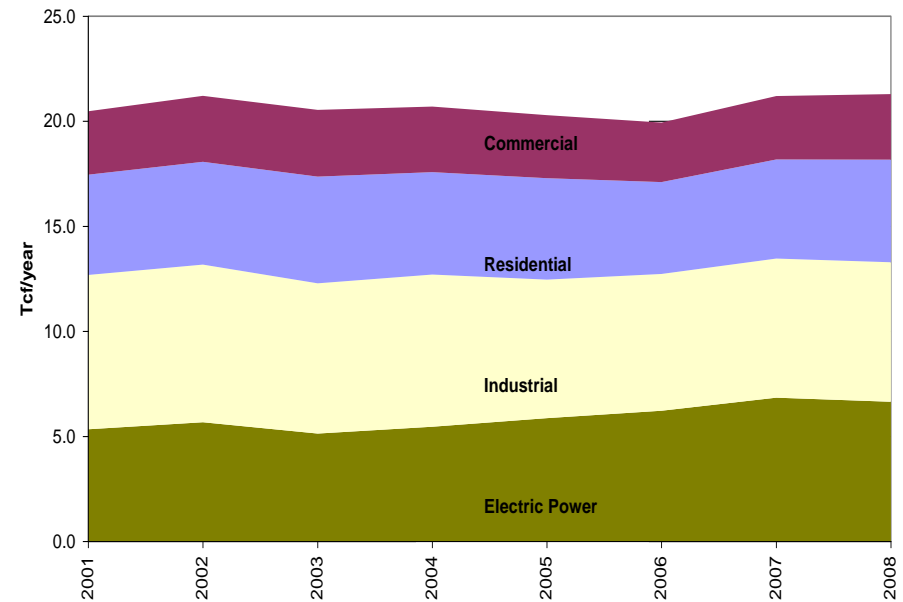
1	Demand
2	Price
3	Supply
4	Implications for the Future

# Demand

## Since 2001 U.S. Natural Gas Demand Has Been Up - Moderately

- » *Total U.S. natural gas demand* has increased 0.7% pa, growing from 22.2 Tcf in 2001 (60.9 Bcfd) to 23.2 Tcf (63.7 Bcfd) in 2008.
- » Over the same period, the **residential and commercial sector** has increased slightly less, 0.5% pa, while the **industrial sector** has declined 1.3% pa (from 20.1 to 18.2 Bcfd).
- » The **electric generation sector** has increased most dramatically, up 3.4% pa over the period; but for a decline in 2003 of -9.5%, it would have been up 4.7% pa.
- » Affected by high gas prices in the first half of 2008 and the financial crisis in the last half – *U.S. electric generation gas demand was off - 2.8% in 2008, while total demand was up < 1%.*
- » A bright spot for U.S. gas demand was *vehicle fuel consumption (not shown), which increased 11.2% pa*, as of now only a 30 Bcf pa market (82 MMcfd).

US Natural Gas Demand by Sector



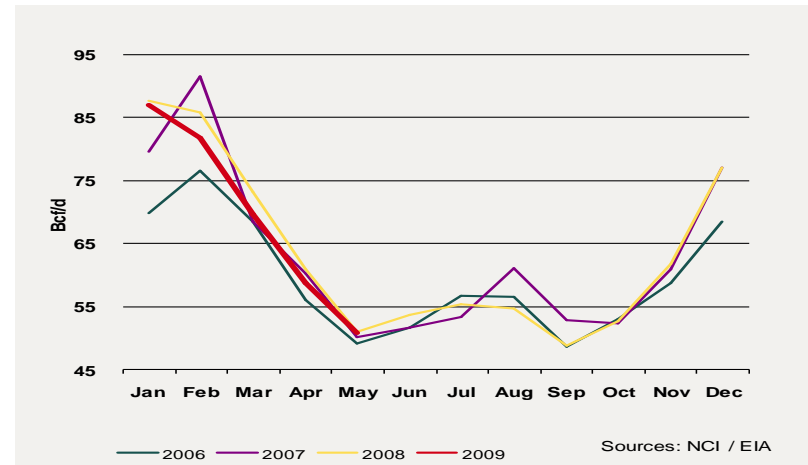
Source: EIA

# Demand

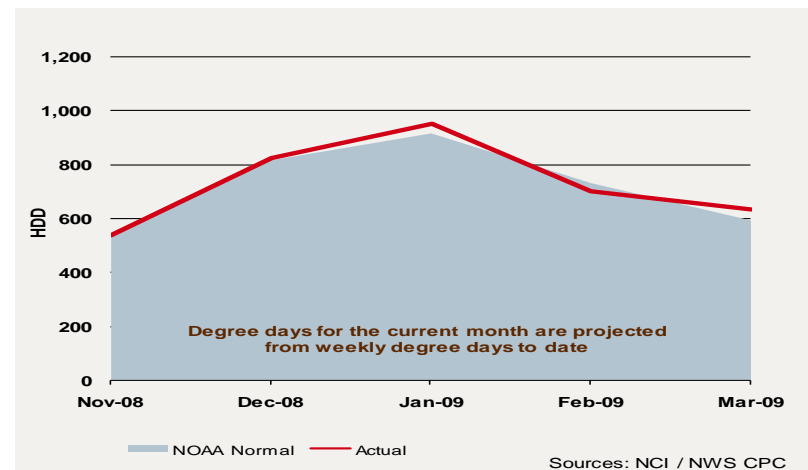
## Despite a Gloomy Economy, U.S. Total Gas Demand This Winter Has Been Fairly Flat

- » U.S. total natural gas demand Nov08-May09 has been down 2% compared to last year.
- » Some industrial demand (steel and basic chemical industries) have had gas demand off 30-50% on global competition and economics.
- » Weather has essentially been ... *a bit 1.3% colder than last year through March, but not a great factor in assessing consumption trends.*

U.S. Total Gas Demand



U.S. Population Weighted HDD

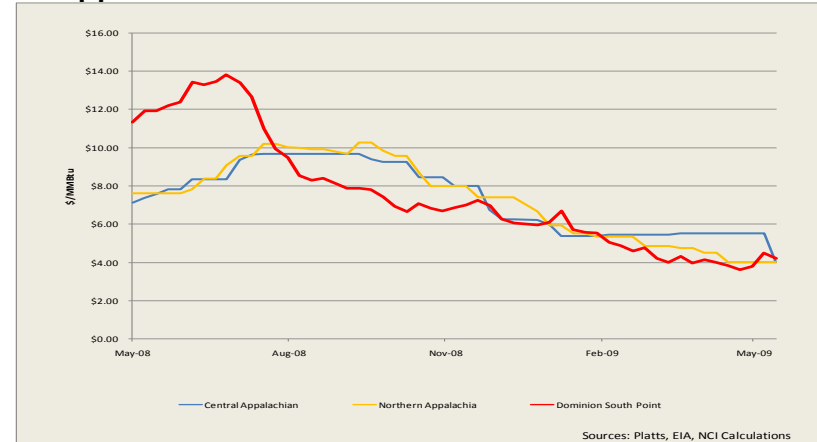


# Demand

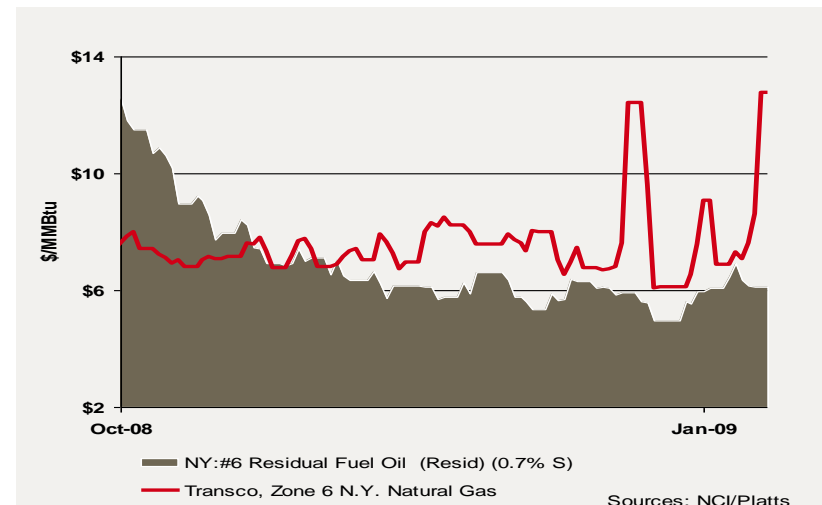
## Recent Low Gas Commodity Prices Have Supported Gas Demand At the Expense of Coal through Fuel Switching

- » From Aug08 – May09, gas prices have been below coal prices in the heavy coal consuming South and Northeast electric generation markets.
- » While gas prices do not need not to fall below coal prices in order to promote coal-to-gas substitution on increased efficiency, gas prices nevertheless were lower 'straight-up'
- » Unusually high crude oil prices last fall – also tended to support gas-fired generation.
- » Recently the uptick in oil prices to over \$60 and now \$70 per bbl and ongoing weak gas prices will again be supportive of oil-to-gas switching in NY.

Appalachian Coal vs. Dominion Natural Gas



NY Resid Oil vs. Transco Z6 NG



## Table of Contents

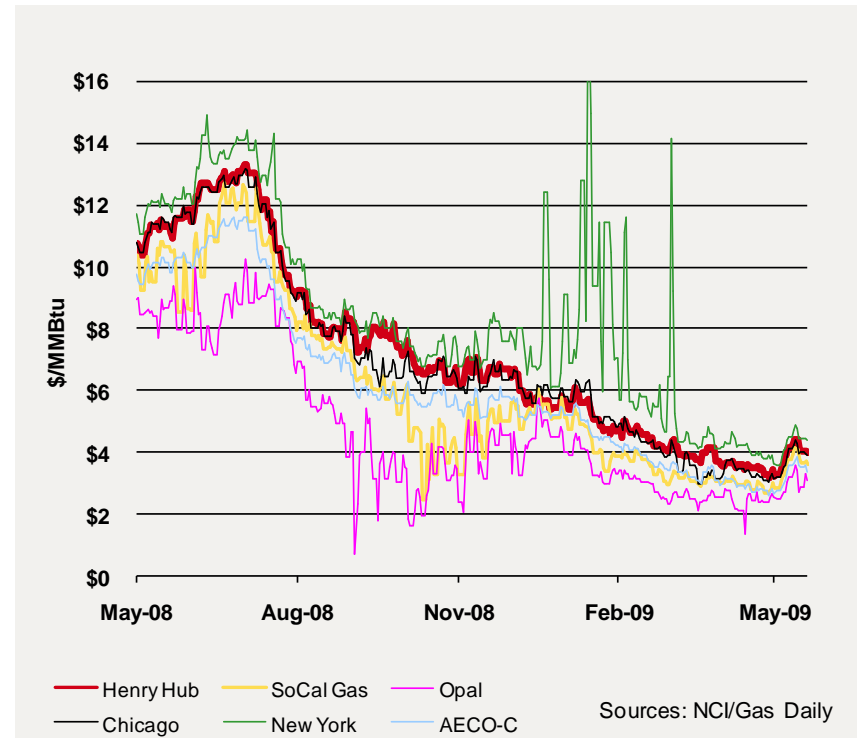
1	Demand
2	Price
3	Supply
4	Implications for the Future

# Price

## Spot Gas Price Trend has been Down Since August 2008 Peaks

- » Fundamental gas supply surplus supports weak gas prices, possibly through 2009.
- » Spot prices have been in a downtrend since July 2008, though they appear to be settling into a range from the mid \$3.00 to low \$4.00's at Henry Hub.
- » In supply driven market, demand would need to come back very strong or production to decrease sharply, to reverse current gas price weakness this year.
- » This seems unlikely given the current economic climate and current gas production trends.

Spot Gas Prices

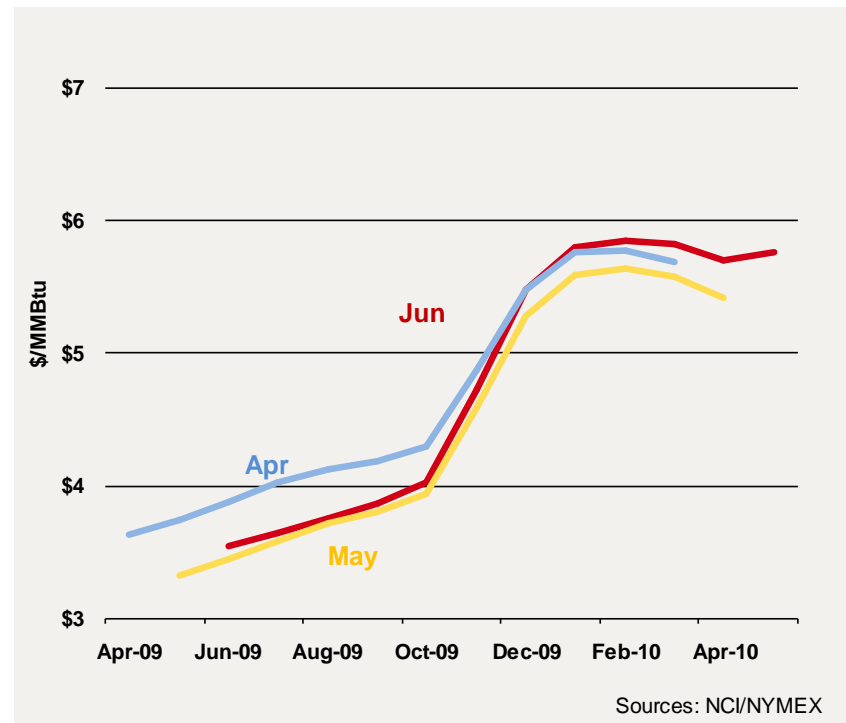


# Price

## Futures Price Trend Has Been Down Over Last Three Months

- » Futures market indicates weak price through 2<sup>nd</sup> and 3<sup>rd</sup> Quarters, then strength in 4<sup>th</sup> Q'09.
- » Current contango in futures results in steep 4<sup>th</sup> Q increases in prices.
- » As time goes on, winter contango could be under pressure to decline otherwise shows signs of turning price trend.
- » Market fundamentals should be watched for signs – especially coal plant shut-ins and signs of oil prices strength, perhaps LNG imports.

NYMEX Futures Prices at Monthly Close



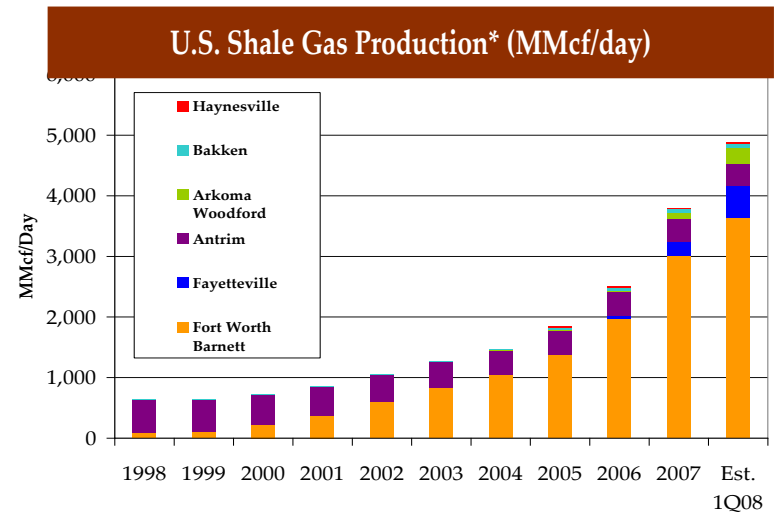
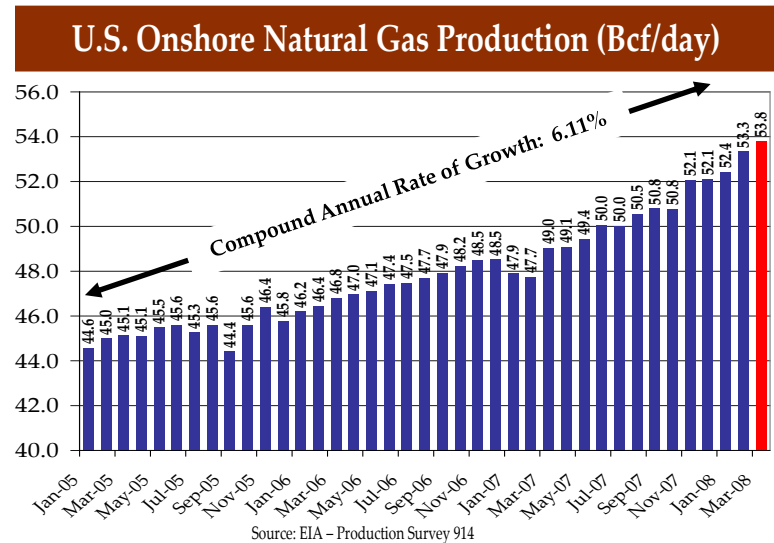
## Table of Contents

1	Demand
2	Price
<b>3</b>	<b>Supply</b>
4	Implications for the Future

# Supply

## Remember NCI's North American Gas Study in July 2008

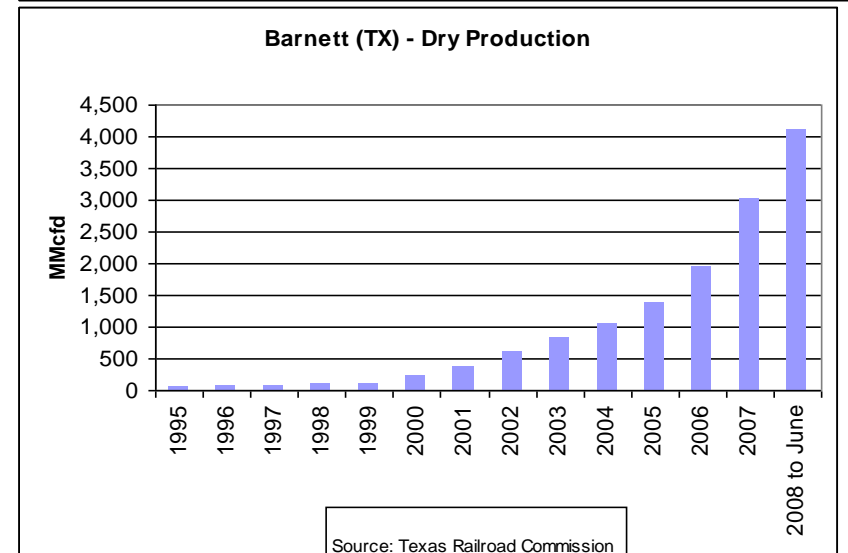
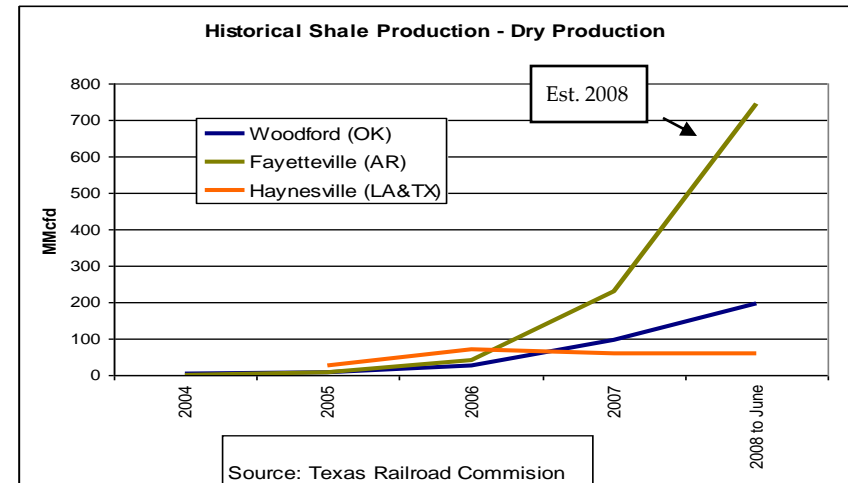
» NCI's North American Natural Gas Resource Assessment study for American Clean Skies Foundation last July, reported tremendous increases in domestic natural gas production through 2<sup>nd</sup> Q'08.



# Supply

## U.S. Year End 2008 Production Numbers Indicate there is a Continuation of Accelerating Shale Gas Production Growth

- » Through 1<sup>st</sup> Quarter of 2009, shale play production volumes continued up – despite challenging financial market conditions and low spot prices.
- » Haynesville shale estimates, (the next big play) are now to 8-10 Bcfd, or 2.5 times current Barnett!
- » NCI still suggests - development will depend on the rate of market growth!

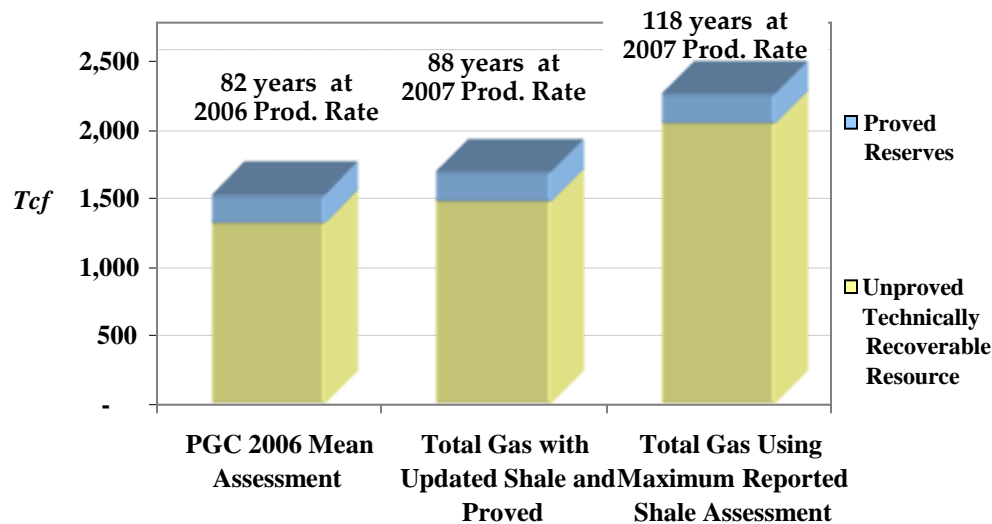


# Supply

## A Finding of the NCI Study Then Was that Proved Reserves Plus Assessed Resources – Resulted in An Expanded Life of the Gas Resource

- » The 2006 Potential Gas Committee (PGC) total P3 (proved, probable, and potential) resource estimate was 1,530 Tcf, inclusive of 204 Tcf of proved reserves. At that year's U.S. production rate, this is *82 years'* worth of gas supply.
- » Remarkably however, the maximum reported assessment for shale, according to producer reports collected by NCI, is 842 Tcf. Using this estimate, the total would increase to 2,247 Tcf, *118 years* of production at 2007 levels.
- » New PGC report to be released June 18, 2009 at AGA. Early indications are that new report picks up new shale supply and will increase 2006 resource estimates.

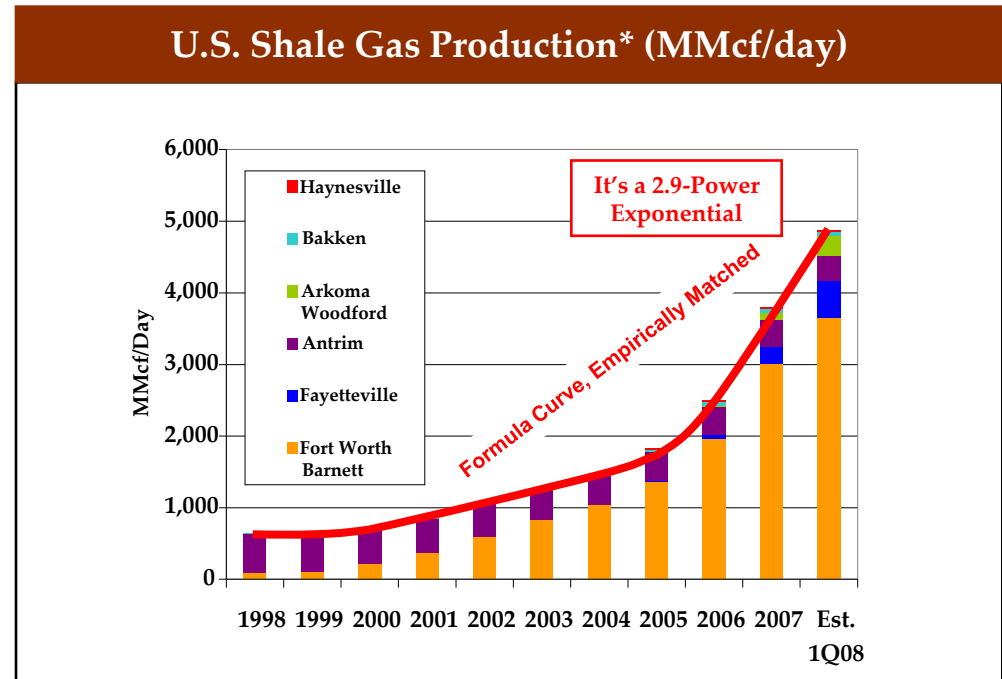
### U.S. Total Gas Supply (Tcf)



# Supply

## What is Apparent is that Gas Shale Production Has Experienced Tremendous Growth, with the Barnett Shale in Texas Leading the Way

- » Study showed Barnett growing from 0.094 Bcfd in 1998 to 3.0 Bcfd in 2007; an increase of more than 3000%; latest Barnett production actuals are 4.6 Bcfd or 8.1% of total U.S. production (from Lippman Consulting, Q32008).
- » Fayetteville, Haynesville, and Woodford were also reported as showing signs of ramping production with Marcellus identified as being next.
- » Technology has allowed access to and economic production of a vastly greater resource base. Specifically, *improved hydraulic fracturing* techniques and improved *horizontal drilling* have allowed tight, geographically diffuse reserves to be developed in large volumes.

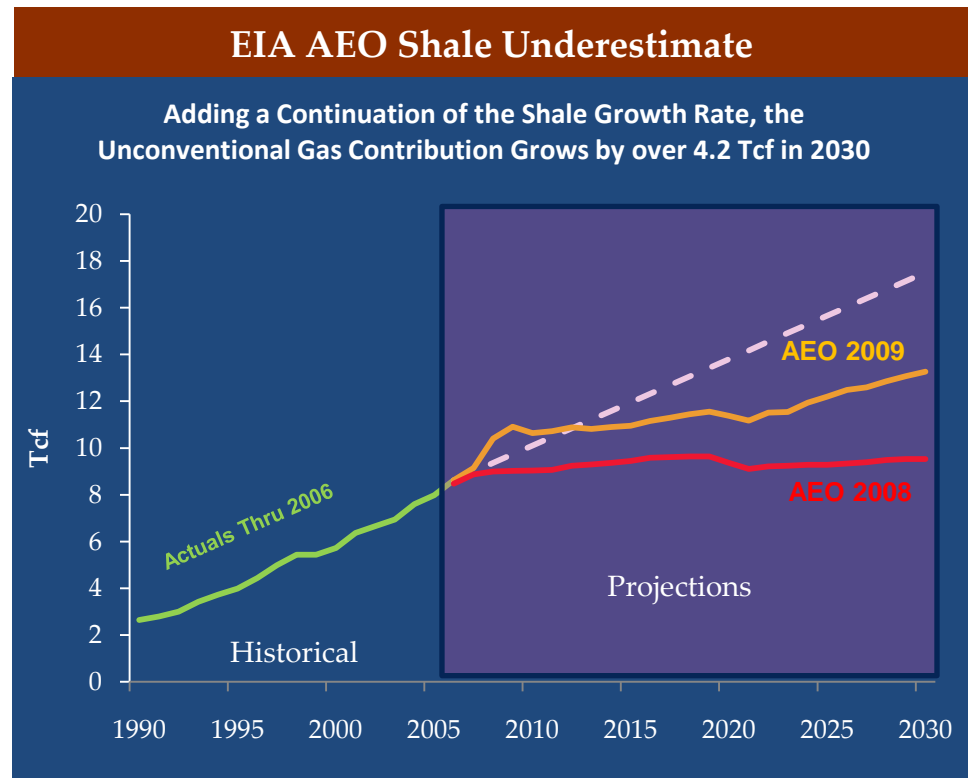


Sources: Lippman Consulting, Inc. Production Database, Michigan Public Service Commission, Arkansas Oil and Gas Commission and NCI Calculations.

# Supply

## In the Past, The Federal EIA Has Tended to Under Forecast Gas Production, Especially Shale

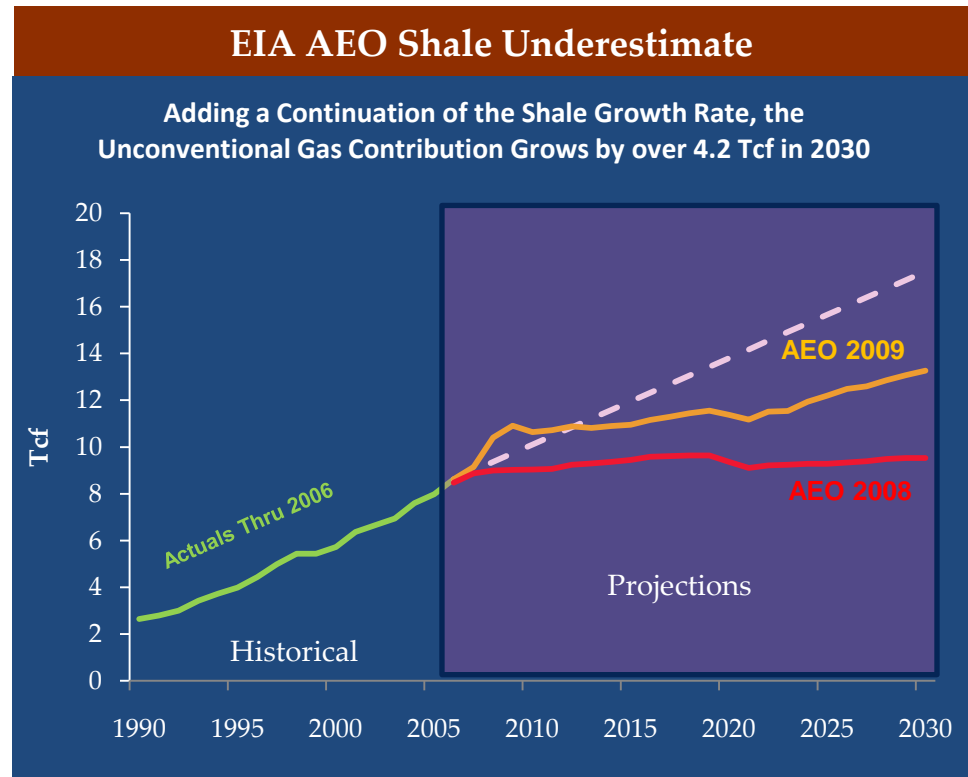
- » Measuring the rapidly increasing growth in shale production, then projecting it if the resource base can support it, yields an unconventional gas contribution well in excess of even EIA's most recent forecast in the AEO09.
- » This despite the EIA having dramatically increased their previous U.S. domestic gas forecast for unconventional gas, including shale by 2030 by 43.5% from AEO08.
- » Yet we believe the EIA's new forecast is likely again to be too low in its forecast of domestic US shale gas!



# Supply

## EIA Has Tended to Underforecast Gas Production, Especially Shale (Cont.)

- » The key questions of course to answer are:
  1. Is the rate of growth continuing; *and*
  2. Can the resource base support it?
- » The answer to 1. **Yes, so far** – Long Term, **To Be Determined.**
- » The answer to 2. **Yes, clearly.**

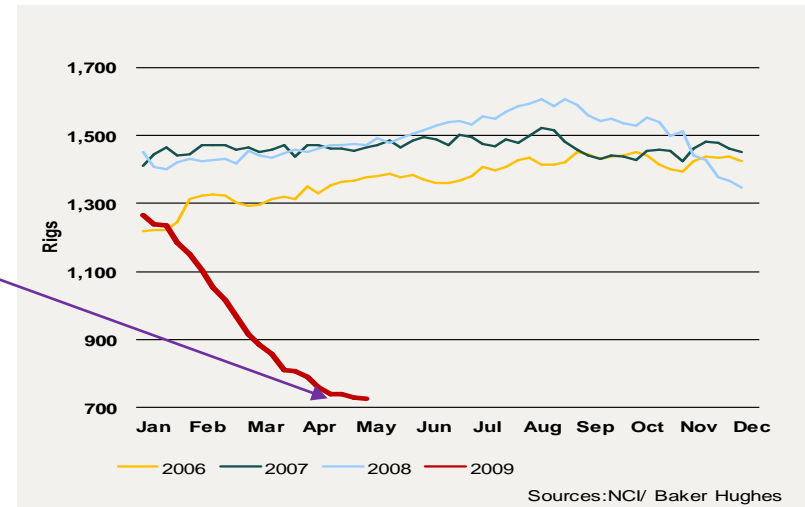


# Supply

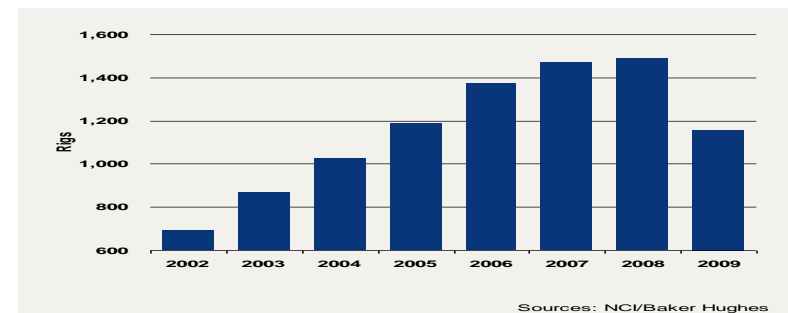
## Forewarning of a Possible Supply Correction - Total U.S. Oil and Gas Drilling and Gas Directed Drilling is in Sharp Decline

- » Combined oil and gas drilling is off 27% from one year ago.
- » U.S. gas drilling off 217 rigs in May and down 29% from one year ago.
- » Gas drilling trend has been in *free-fall*.
- » Overall weekly average gas drilling rig count is now down below levels last seen in 2005.

U.S Weekly Natural Gas Rig Count



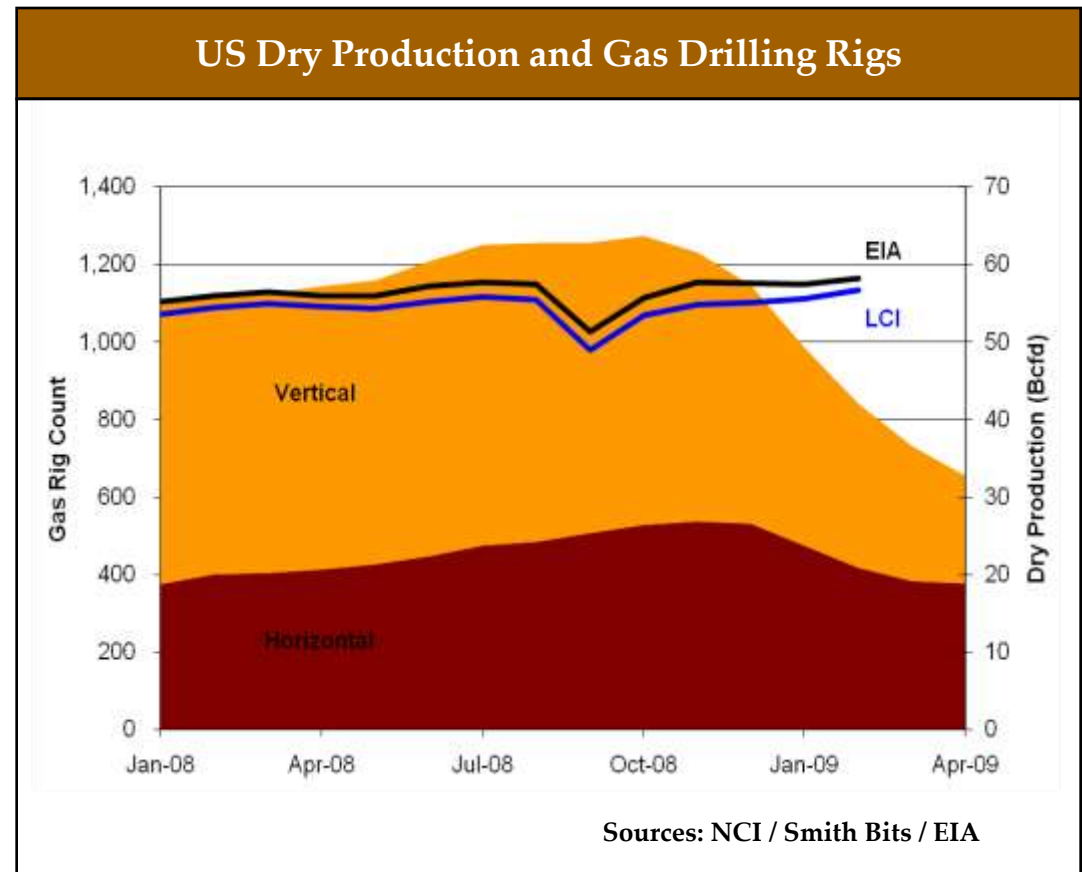
U.S. Average Gas Rig Count All Types



# Supply

## Since Last Fall, Vertical Gas Drilling Has Dramatically Declined – Horizontal Drilling Mostly Flat. Gas Production Is Holding Up, so Far

- » Vertical gas rig counts have fallen off significantly since last year, experiencing a decline of 66% (262 rigs in the week ending April 24) from the peak of 781 rigs for the week ending July 4, 2008.
- » Horizontal gas rig counts have also declined, but at 377 rigs for the week ending April 24 are still at levels near last year's low of 356 rigs off 6% (week ending Jan 4, 2008) and relatively flat year over year.
- » U.S. production is holding relatively flat, due to unconventional supplies especially from gas shales.

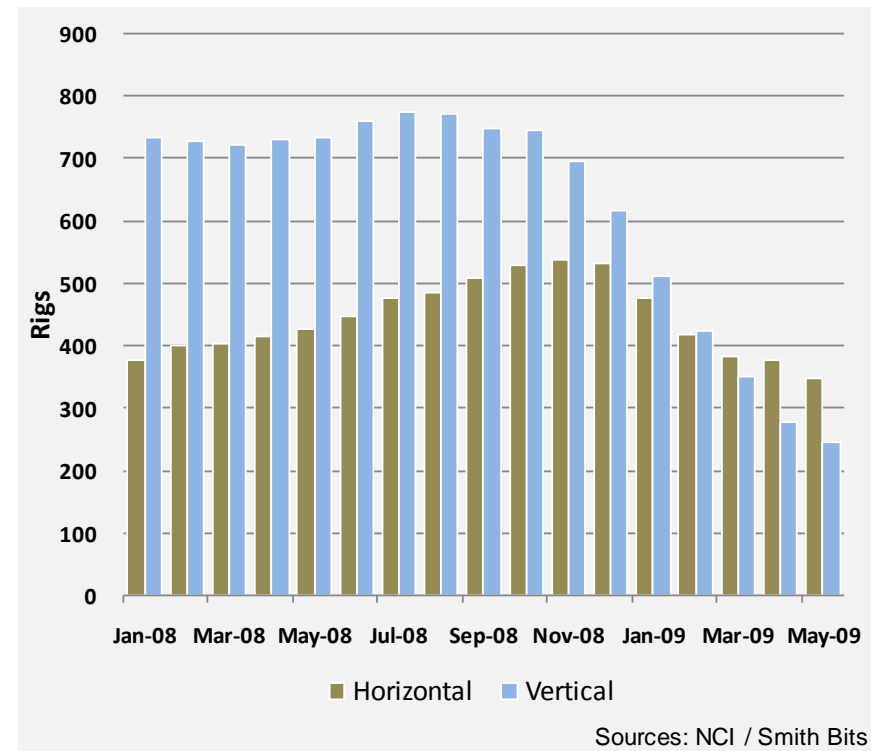


# Supply

## Only Lately Has U.S. Horizontal Gas Well Drilling Started to Decline

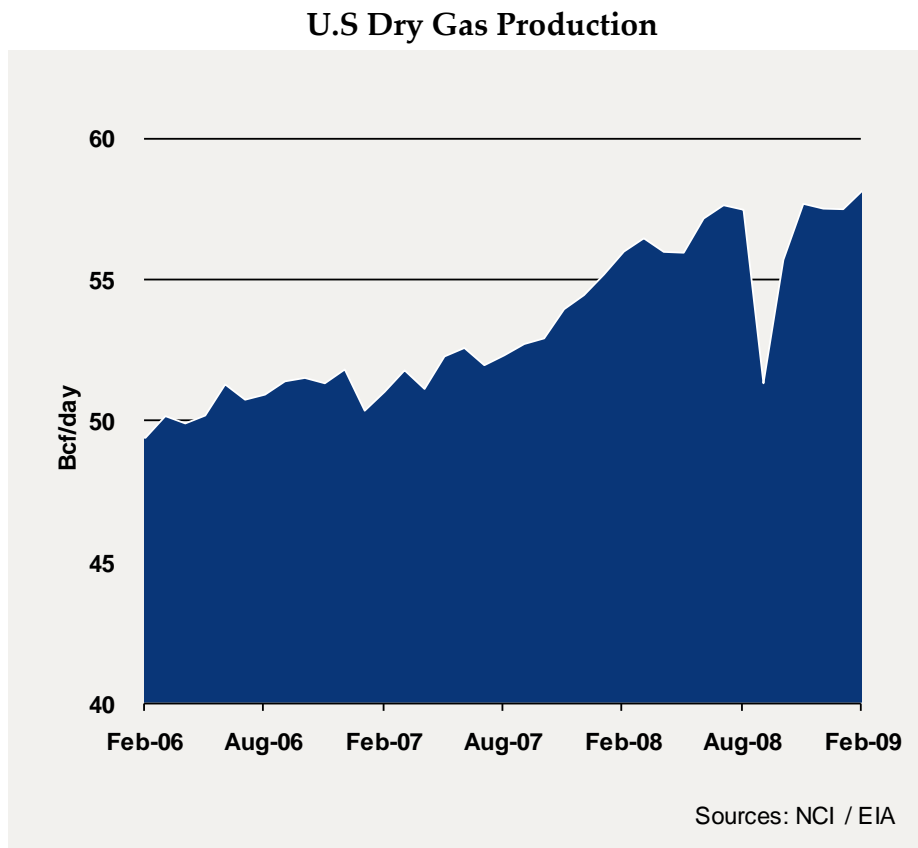
- » Horizontal drilling statistics are important to understanding shale activity.
- » Nearly all shale is developed via horizontal drilling activity.
- » Shale gas also remains the most prolific source of *new* gas supply in North America.
- » U.S. horizontal gas drilling was off 8% in Feb09 for example, *yet still higher than horizontal gas drilling activity Feb08.*

U.S Gas Rig Count by Well Type



# Supply

**Driven by Unconventional Gas, U.S. Gas Production Levels are Now at their Highest Levels Since 1970's!**

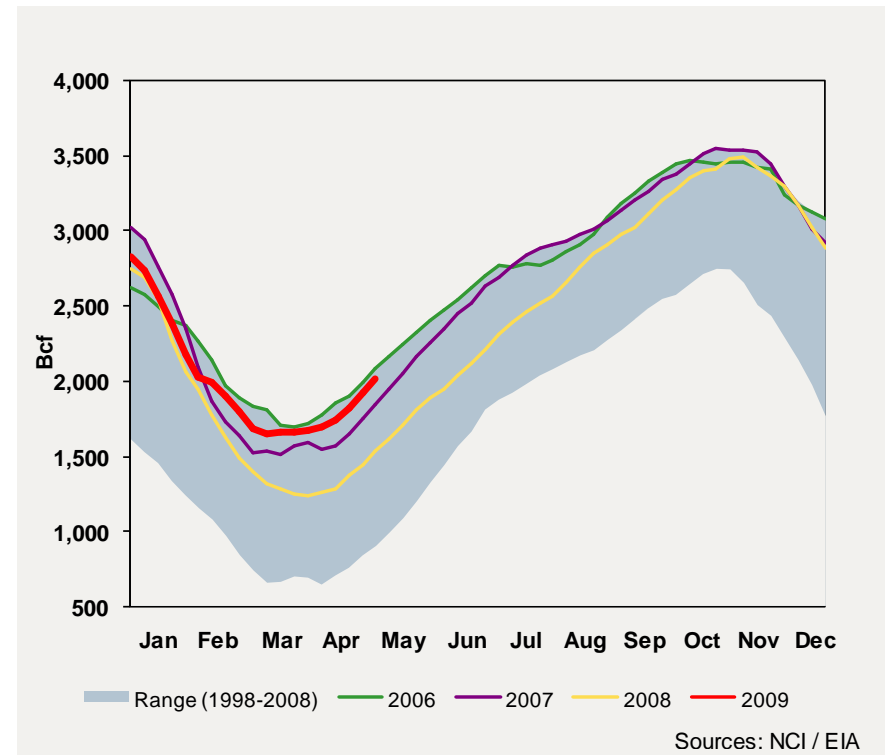


# Supply

## U.S. Storage Levels are Also Above Average for Time of Year

- » U.S. storage levels are currently at levels above last year and above the 10 year average.
- » Supply and storage inventory levels, support bearish short-term pricing signals.

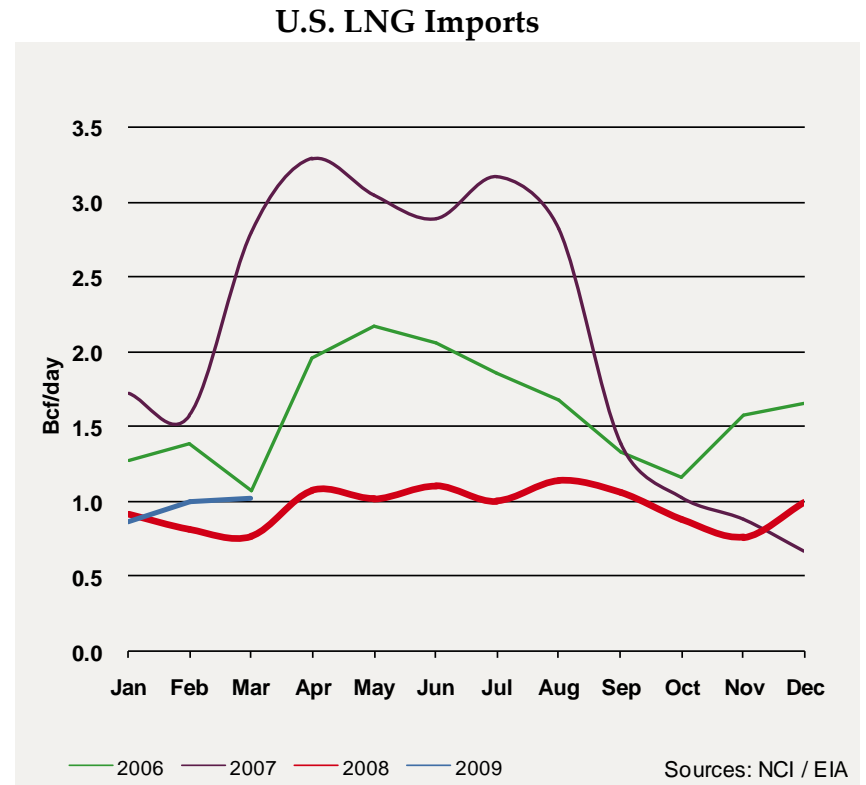
U.S. Gas Storage



# Supply

## Meanwhile U.S. LNG Imports are Showing Signs of Being Challenged to Compete With Domestic Supply

- » U.S. LNG imports averaged only 0.8 Bcfd in November 2008, compared to 'new' regasification capacity of about 11.0 Bcfd.
- » LNG shipments to NA are likely to remain low, although current price parity with UK may bring additional LNG cargoes as early as this summer from Trinidad and from elsewhere and otherwise headed for Europe.
- » As reported recently, NCI also sees signs of natural gas supply being exported from Mexico into the US over the next few years.



# Supply

## Major Shale Basins are Located Across the Entire U.S. and Canada

### Major U.S. Shale Basins



## Supply » U.S. Natural Gas Shale Basins Align with the Pipeline Grid



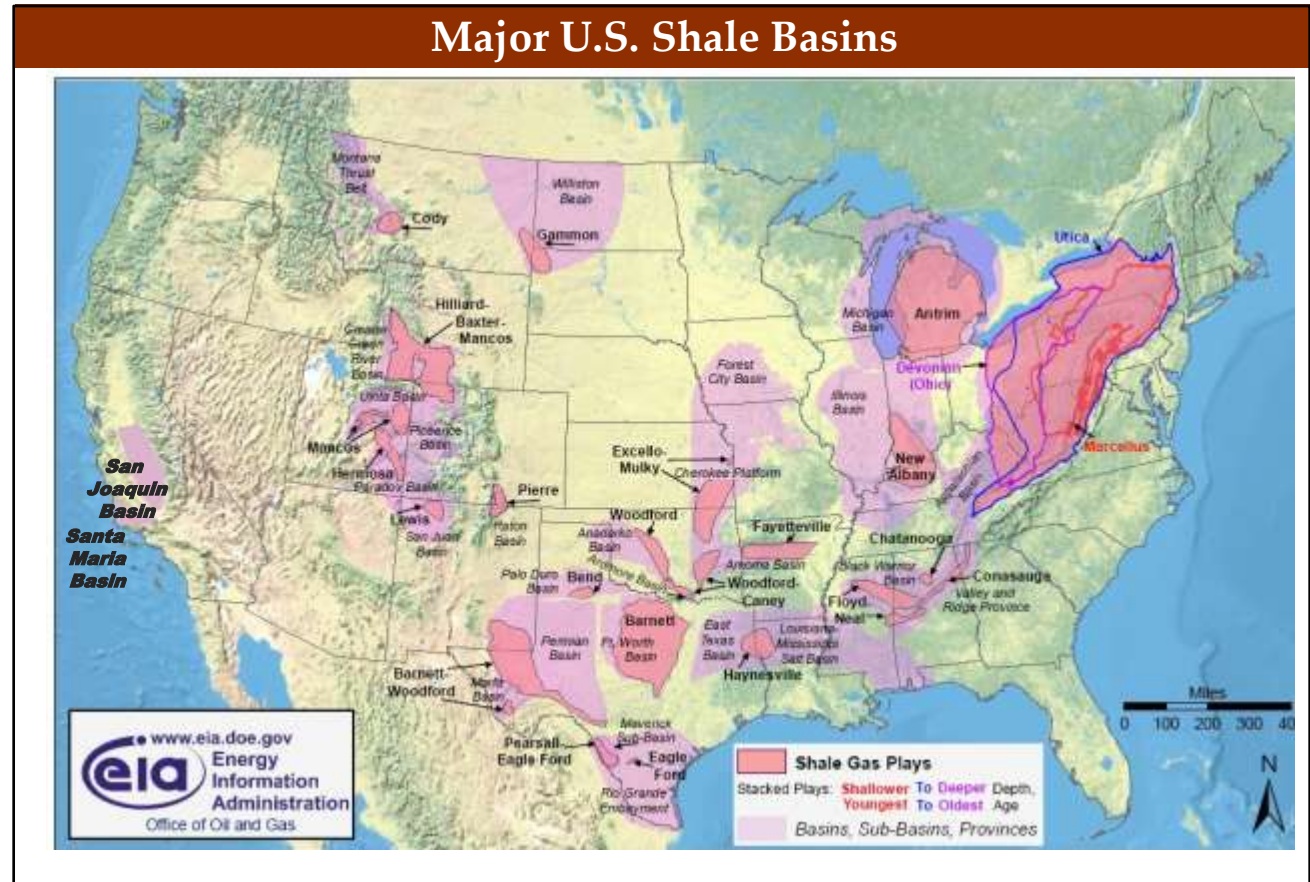
Sources: EIA, US Natural Gas Pipeline Network,  
American Clean Skies Foundation

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# Supply

## Major Shale Basins are Located Across the Entire U.S.

- » There are at least 21 shale basins in over 20 states in the U.S.
- » Producing areas include Antrim, Barnett, Devonian, Fayetteville, and Woodford.
- » Emerging plays include Haynesville and Marcellus.
- » In California, the Monterey and McClure basins (within the San Joaquin and Santa Maria basins) are potential gas shale plays.

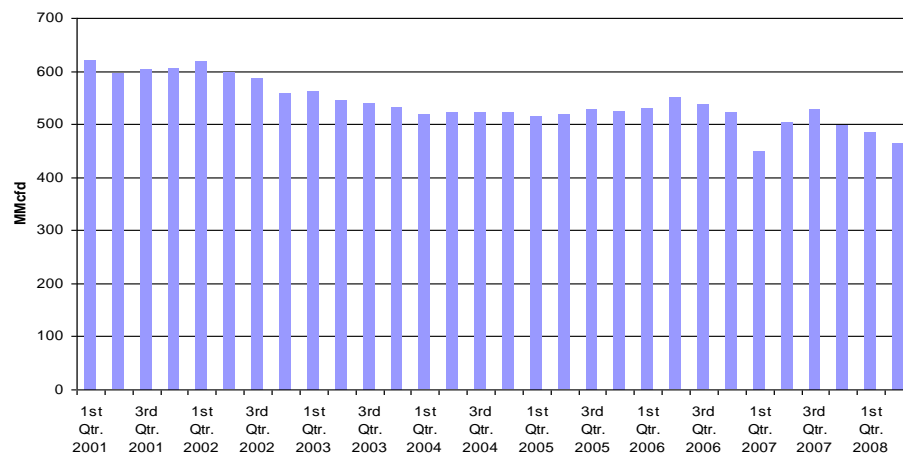


# Supply – California



» Although the USGS does not show any gas shale production or shale reserves in the San Joaquin or Santa Maria Basins - based on activity in other areas the potential to turn around declining gas production in the California shale basins exists.

San Joaquin Wellhead Production (MMcfd)



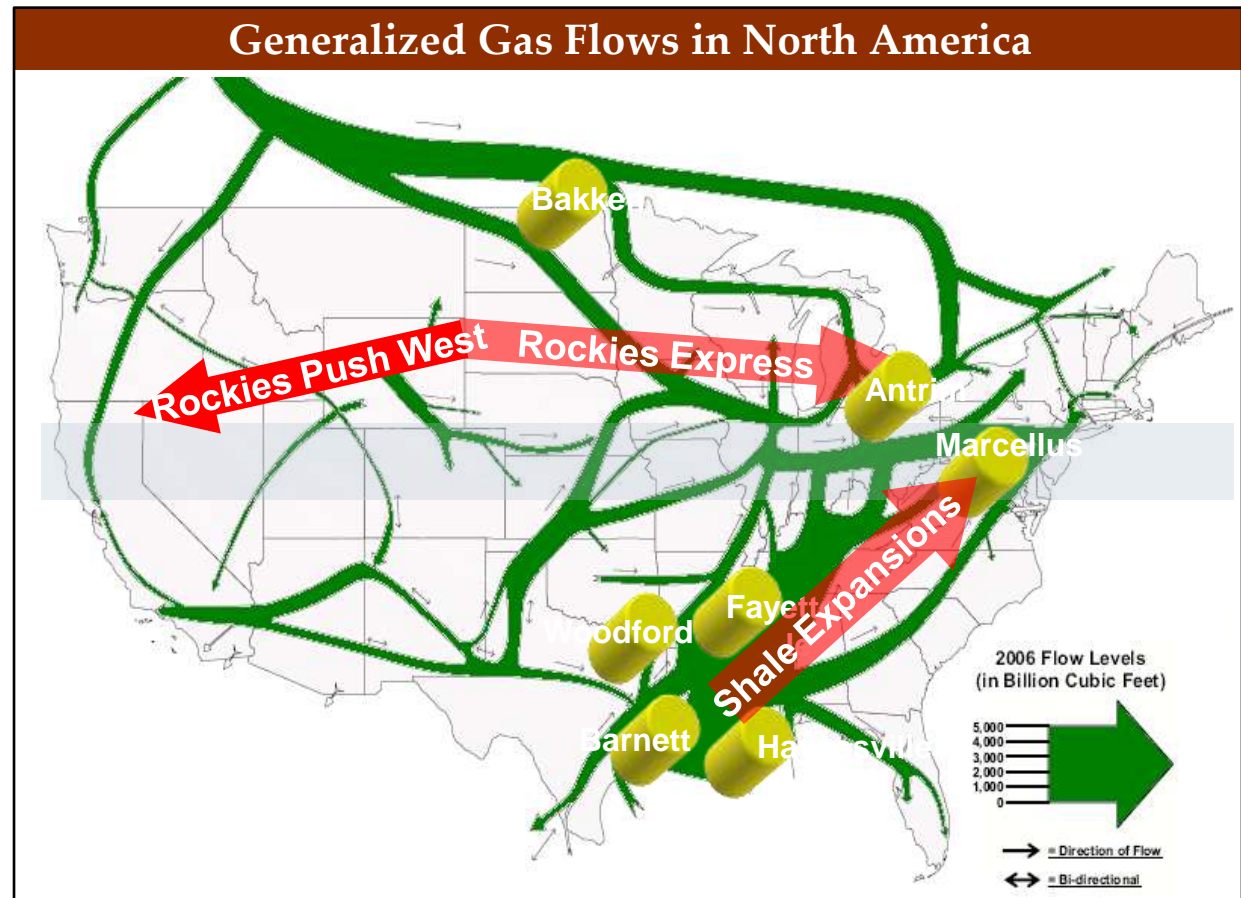
Source: LCI

Source: AAPG/USGS

# Supply

## Potential Implication of Gas Shale Plays for the West

» The major shale developments in other parts of the country will serve the same markets as the new Rockies Express pipeline. Rockies production is apt to get pushed west, into projects such as the new Ruby Pipeline proposed to Malin (CA/OR) border and further south into the Kern River Pipeline to Topock at the SoCal border.



Source: AAPG/USGS

## Table of Contents

1	Demand
2	Price
3	Supply
4	<b>Implications, What is the Future</b>

## Implications , What is the Future?

### Supporting the Demand Side of the Market, It Appears Natural Gas is Well Positioned in the Future Low Carbon Environment

- » History would show that an era of high prices usually has led to a decline in energy demand and in the converse, in a period of low prices gas demand has flourished.
- » A dynamic potentially affecting gas demand is 'climate change' and concerns over carbon and other GHG emissions.
- » This we believe is expansive for gas demand in the intermediate term owing to its attributes as a 'clean' and 'plentiful' solution to this identified issue.
- » Climate change policy, we see then as having the affect of increasing gas demand possibly **despite** higher prices – this given gas's inherent fuel source advantages of being abundant, being clean and being domestic.

## Implications, What is the Future?

### We Also See The Abundant Natural Gas Supply Picture Supporting New Markets

- » Natural gas supply appears well placed to serve an increasing share of the transportation fuel market in the country.
- » In the state with the largest number of vehicles in the country, other legislation already in place in California (AB 118) looks to continue to support increased use of natural gas and other alternative fuels to meet at least a portion of this market.
- » According to the California Energy Commission reports, natural gas usage in place of diesel in the heavy-duty truck sector could cut GHG emissions by 10%-20%.
- » The power generation market seems an even more likely and impactful growth market for natural gas. For the replacement of coal fired generation and for supporting renewable generation such as wind and solar, we foresee a strong ongoing demand for natural gas supported increasingly by the affects of State CA AB 32 the Global Warming Solutions Act of 2006 and US Federal such as Waxman-Markey aimed at addressing climate change and reducing GHG emissions in California and across the country.

# Thank you!

» Discussion

# Contact Information

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