

**4-08-09**

**Presentations:  
Technologies for  
Shale Gas  
Development in  
the U.S.**

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Technologies for Shale Gas Development in the  
U.S.</subject><comm>HEDC26</comm></target>

ALASKA STATE LEGISLATURE  
ECONOMIC DEVELOPMENT, TRADE & TOURISM COMMITTEE

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**Chairman**

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**Committee Members:**

Representative Mike Chenault

Representative Nancy Dahlstrom

Representative Mark Neuman

Representative Kyle Johansen

Representative Mike Doogan

Representative Chris Tuck

Representative Joule

Representative Holmes

State Capitol, Room 120

Juneau, Alaska 99801

House Economic Development, Trade & Tourism Committee Agenda

Joint with House Resources Committee

And

Senate Resources Committee

And

Senate World Trade, Tech. & Innovations

Wednesday, April 8<sup>th</sup>, 3:30pm

House Finance, Room 519

+ **Presentation: Technologies for Shale Gas Development in the US**

**Guest Speakers:**

**Mark Meyer, AGIA Coordinator**

**Porter Bennett, CEO and President of BENTEK Energy LLC**

## **PORTER BENNETT**

BENTEK Energy, LLC, 32045 Castle Court, Ste. 200, Evergreen, CO 80439  
303-988-1320 • pbennett@bentekenergy.com

Porter Bennett is founder, president and CEO of BENTEK Energy. Founded in 1985, BENTEK is a leading analytics firm specializing in the US natural gas market.

Mr. Bennett is

- Chairman of Natural Gas Committee and a Director of the Independent Producers Association of Mountain States Natural Gas Committee, and
- Observer with the Potential Gas Committee and member of the Colorado Oil and Gas Association.
- Mr. Bennett is the author of various articles in the Oil & Gas Journal, American Oil Reporter and other publications. He is also a frequent speaker at GasMart and other natural gas industry forums.

Today BENTEK serves over 210 of top firms and over 5,000 traders in the energy industry, including majors, independent producers, pipeline companies, utilities, as well as the largest energy hedge funds, financial institutions and industry regulators.

### **EDUCATION**

**M.S.**, Colorado School of Mines, Golden, CO  
*Major: Mineral Economics*

**M.A.**, Columbia University, New York, NY  
*Major: International Affairs*

**B.A.**, Lewis and Clark College, Portland, OR  
*Major: History*

# *How Horizontal Drilling & Fracturing Technologies Are Changing Natural Gas Markets*

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*Presented to:*  
**Senate & House Resources and EDT Joint Committee Meeting  
State of Alaska**

*April 8, 2009*

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[www.bentekenergy.com](http://www.bentekenergy.com)

# ***Key Points***

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- **The Energy World has changed. Technology has unlocked unconventional gas resources.**
- **Natural gas should no longer be viewed as unavailable, unreliable or too expensive.**
- **Due to unconventional gas production, the US has become supply long, prices are falling and consumers will benefit.**
- **Burgeoning supplies are overwhelming the nation's pipeline capacity, driving prices even lower.**
- **The production growth creates an historic opportunity to use gas to quickly and significantly reduce our GHGs and reduce our consumption of oil and other high emission fuels.**

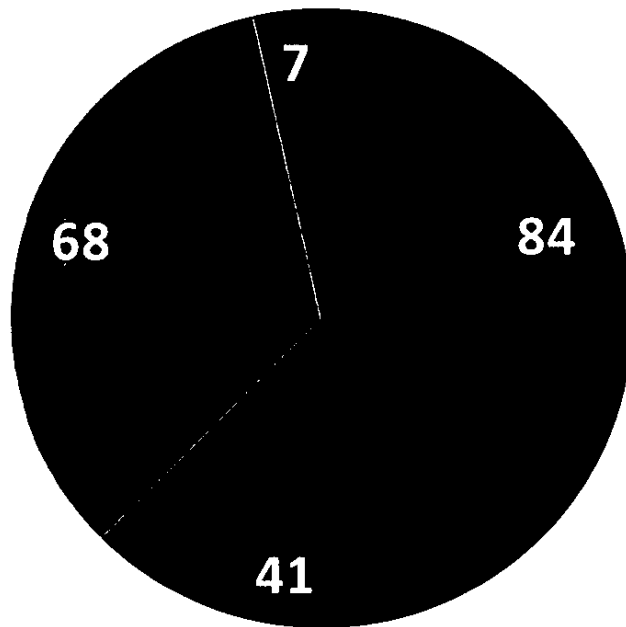
# ***Presentation Outline***

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- **US Supply Explodes: What happened in 2008**
- **Why It Happened: Impact of technology innovation**
- **What are the Impacts?**
- **Recent Activity**
- **Conclusions and Implications**

# Who Is BENTEK?

## Distribution of Customers



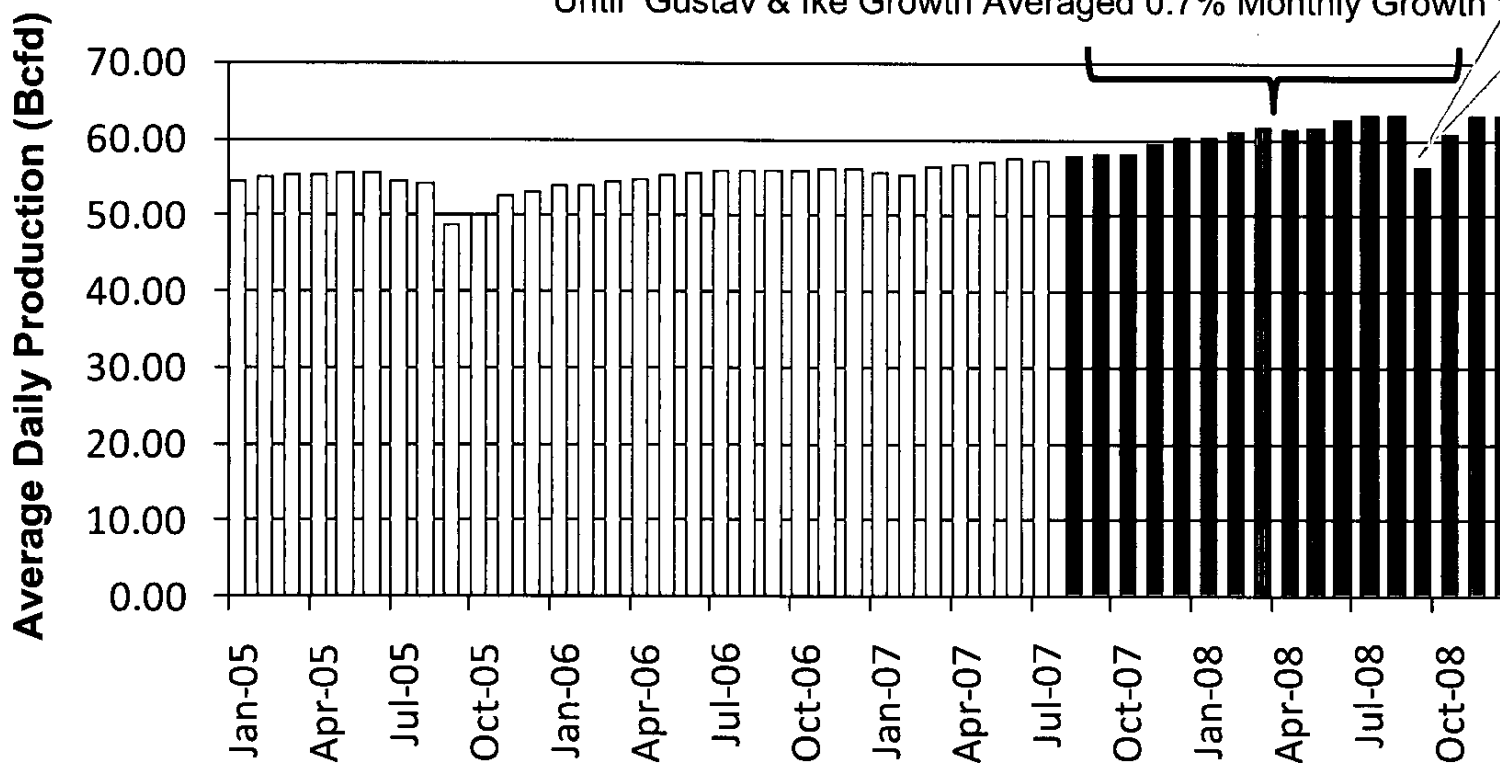
- Majors, Producers, Mktrs, Industrials
- Pipelines, Utilities, Midstream
- Financial and Hedge
- Government, Associations, Consultants

- BENTEK is the leading energy analytics firm
- We provide:
  - Daily assessments of the US natural gas market fundamentals
  - Analysis of major market developments
  - Near real-time Market Fundamentals Data
  - Consulting and Advisory Services
- Over 200 clients include producers, marketers pipelines, banks, LDCs and end users
  - FERC
  - MMS
  - State PUCs via NARUC

# Production Grew In 2008 By 4 Bcfd

08 Production Is Up 7% Over 07

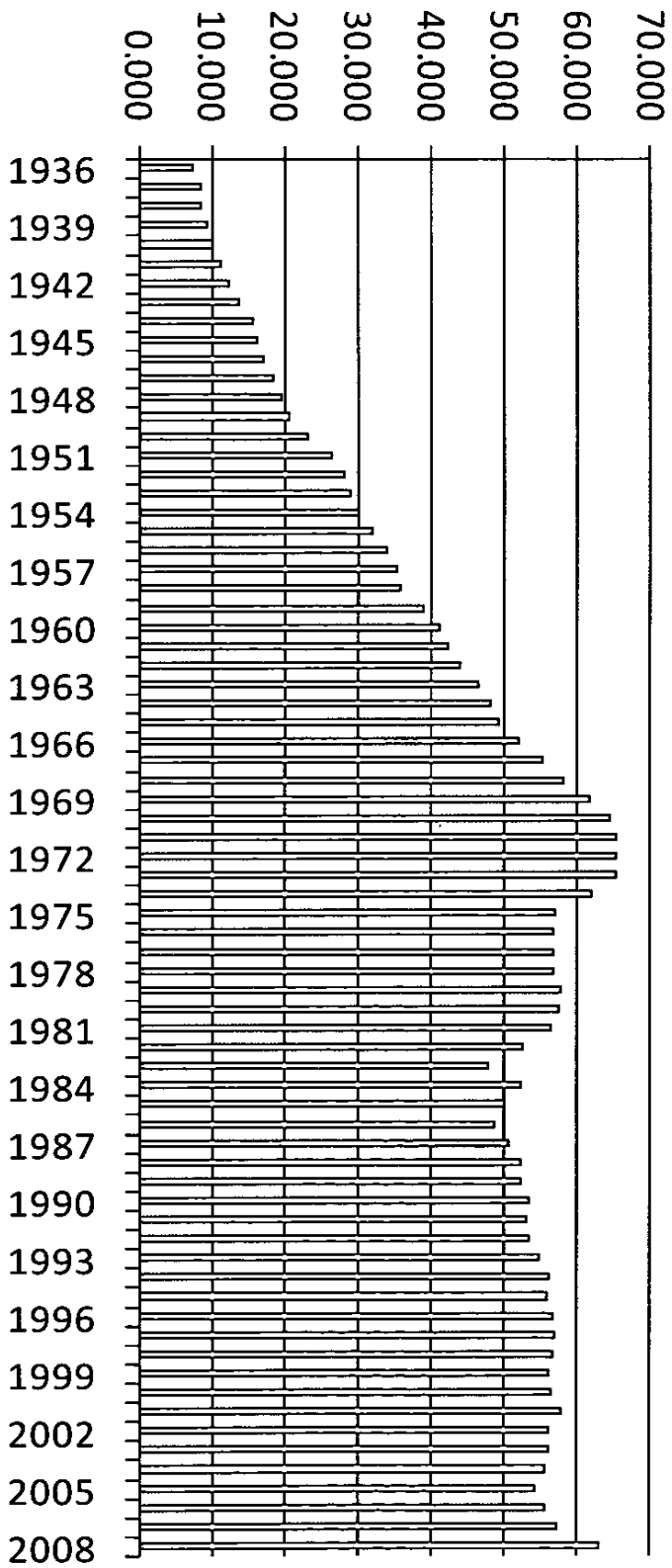
Until Gustav & Ike Growth Averaged 0.7% Monthly Growth



Source: EIA 914 Report  
(Gross Withdrawals)

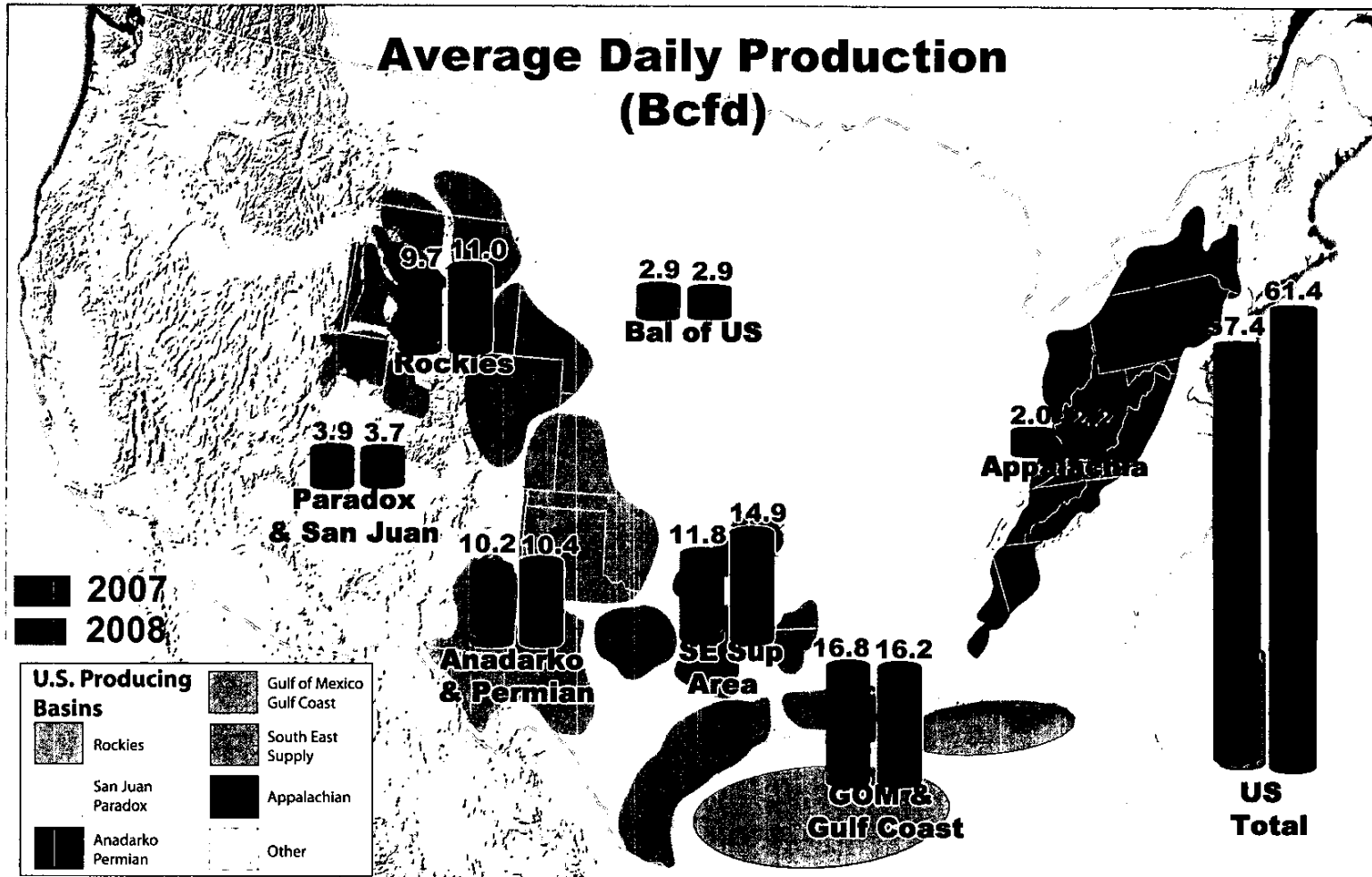
# Production Is Nearing Historic Highs

Lower 48 Gross Withdrawals  
(Bcfd)

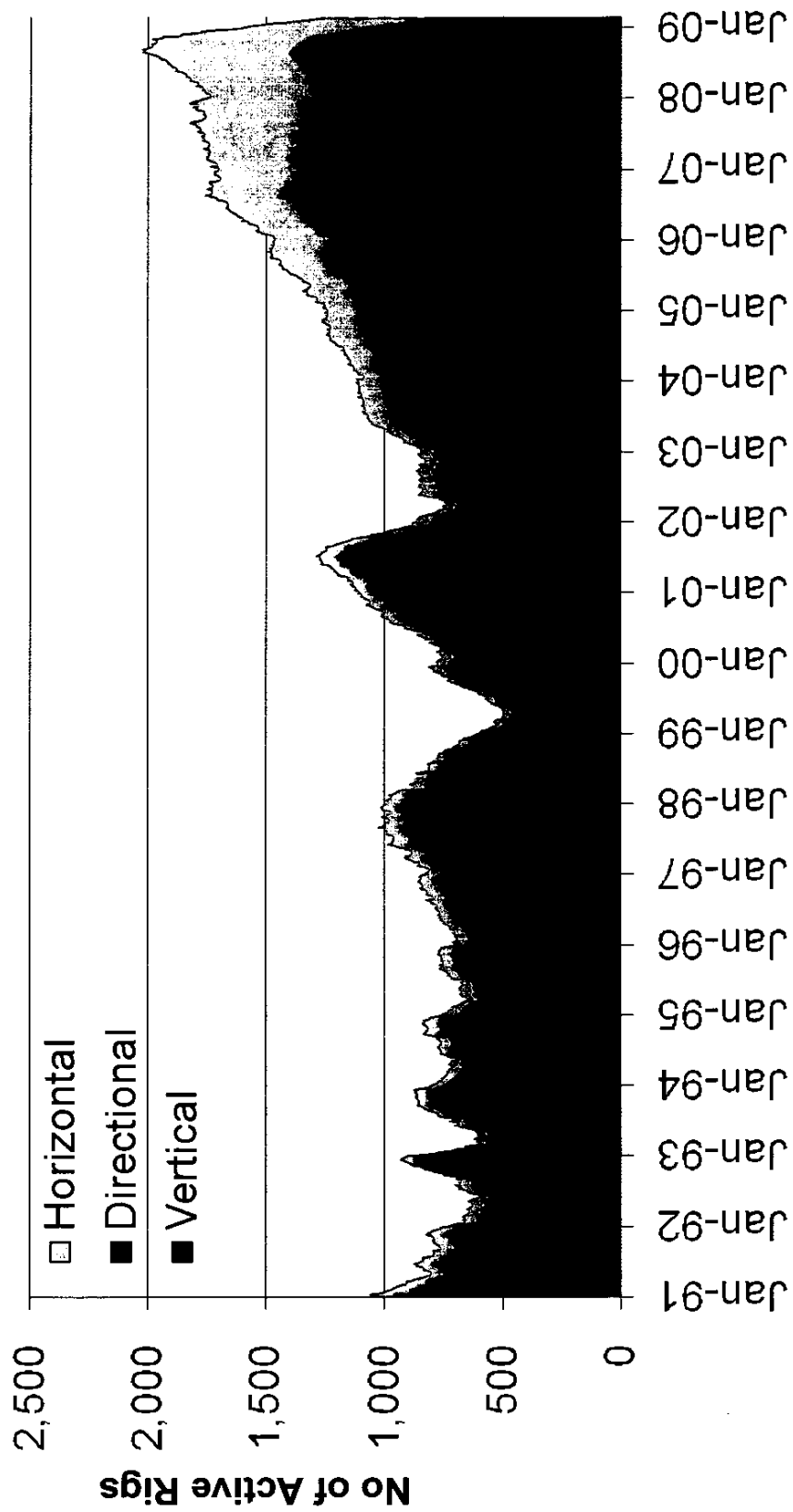


Source: EIA, BENTEK

# Growth Was Greatest In The Non-Conventional Supply Regions



# Drilling Reflects The Shift To Unconventional Production

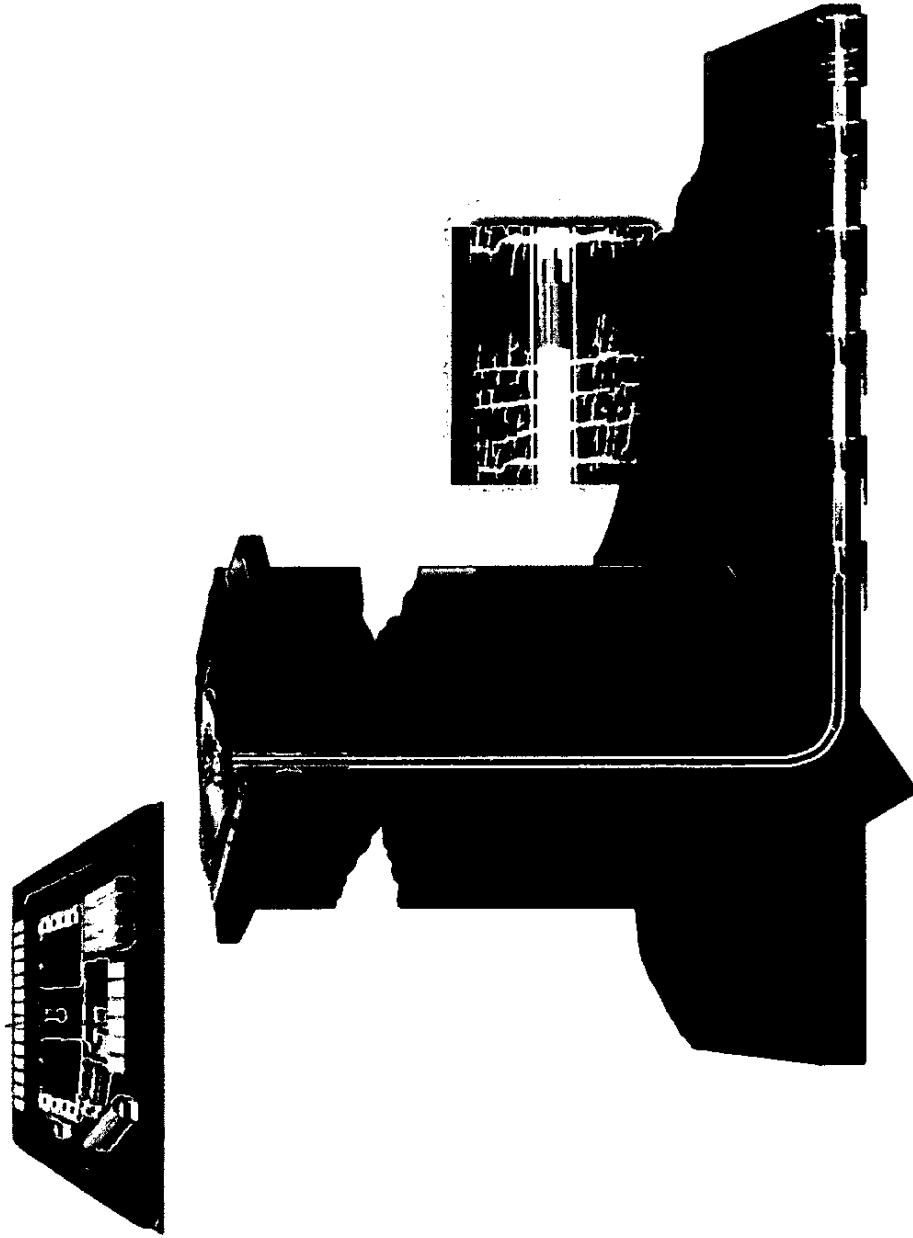


Source: Baker Hughes Direct



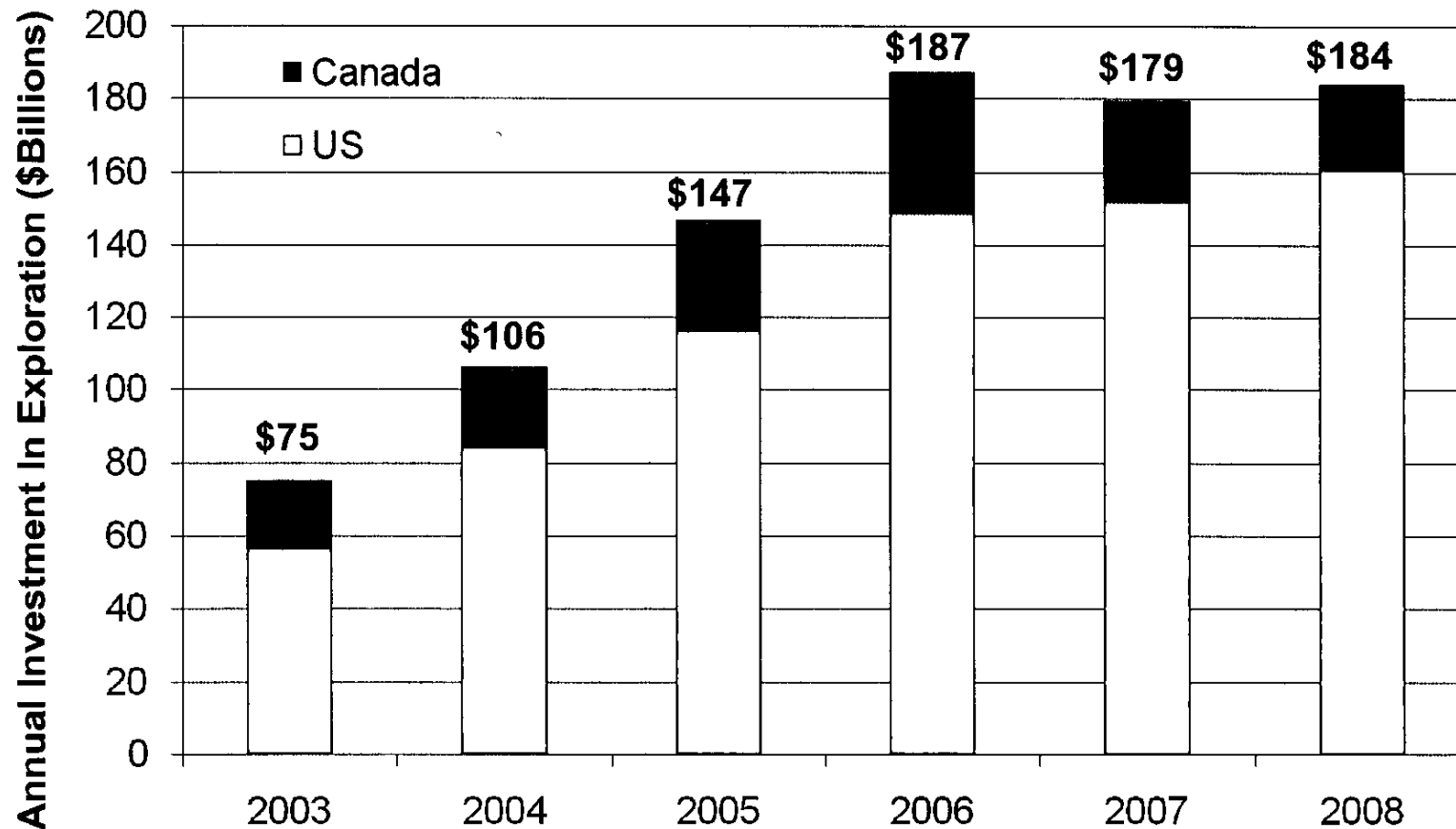
# *Innovative Fracing Technology Is Driving The Growth*

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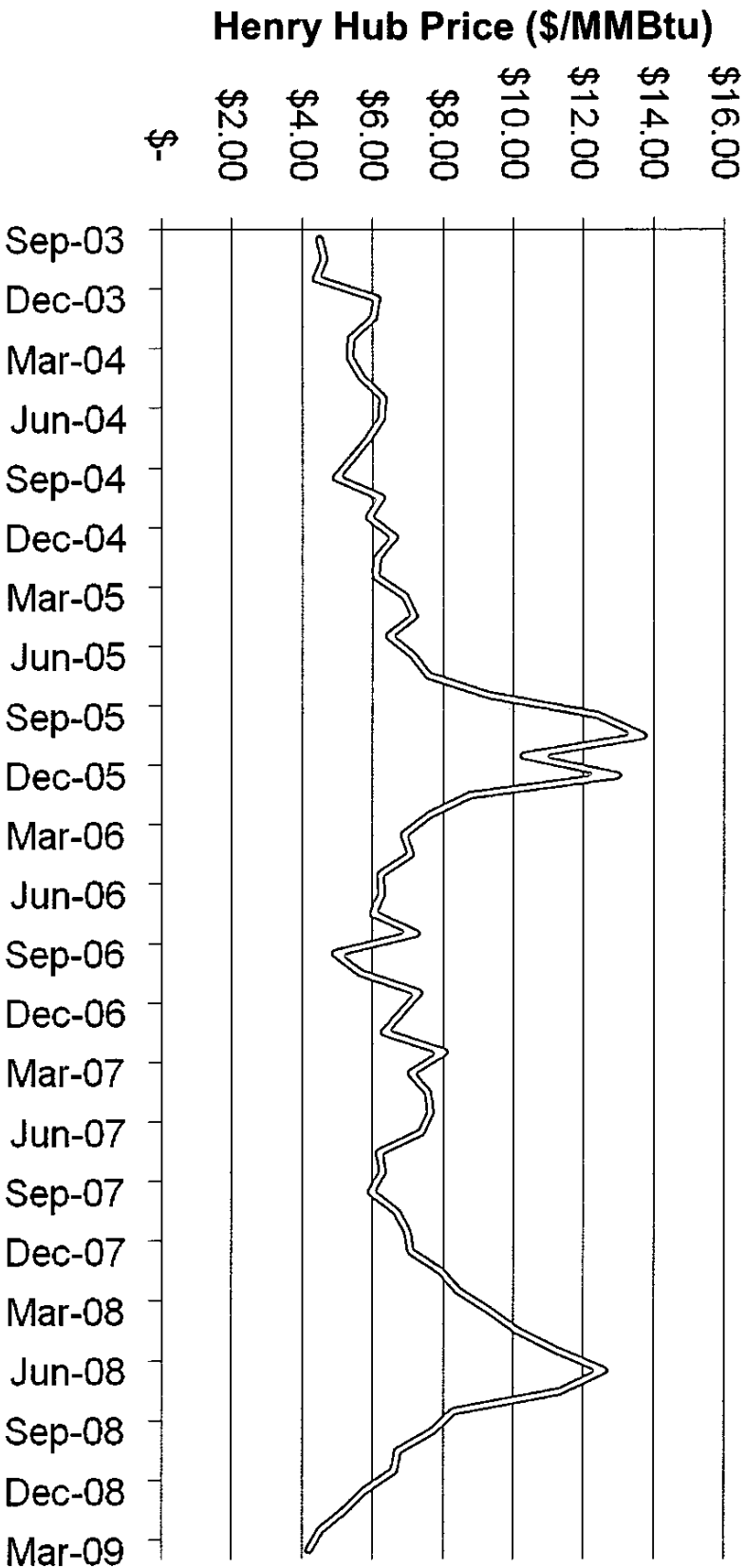
Source: Hydraulic Fracturing Factsheet, prepared by  
Chesapeake Energy, February 2009

# ***Producers Have Invested Nearly \$1 Trillion On Exploration Since 03***

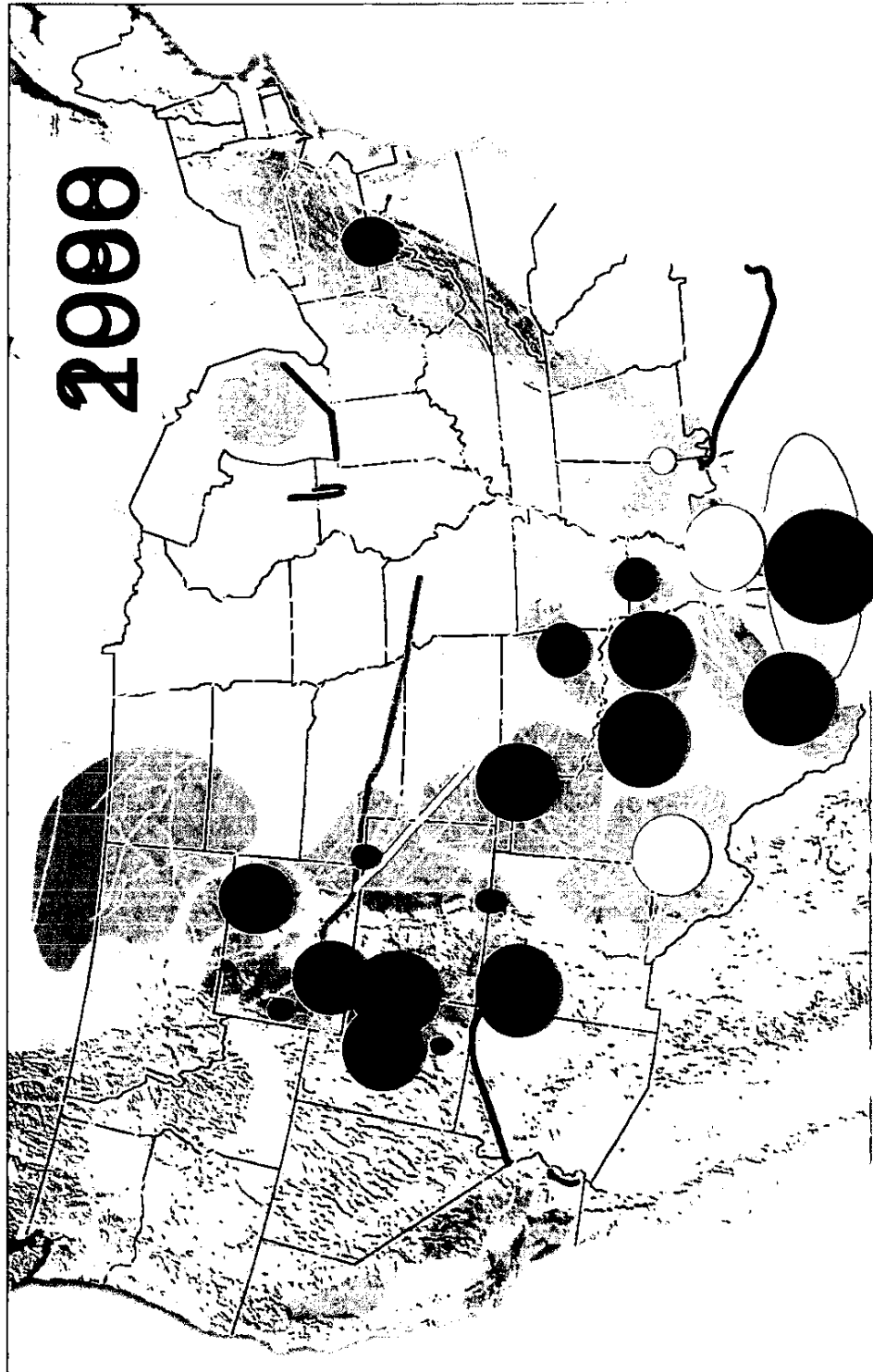


Source: Oil and Gas Journal, Penwell Publications

# Natural Gas Prices Are Falling Precipitously

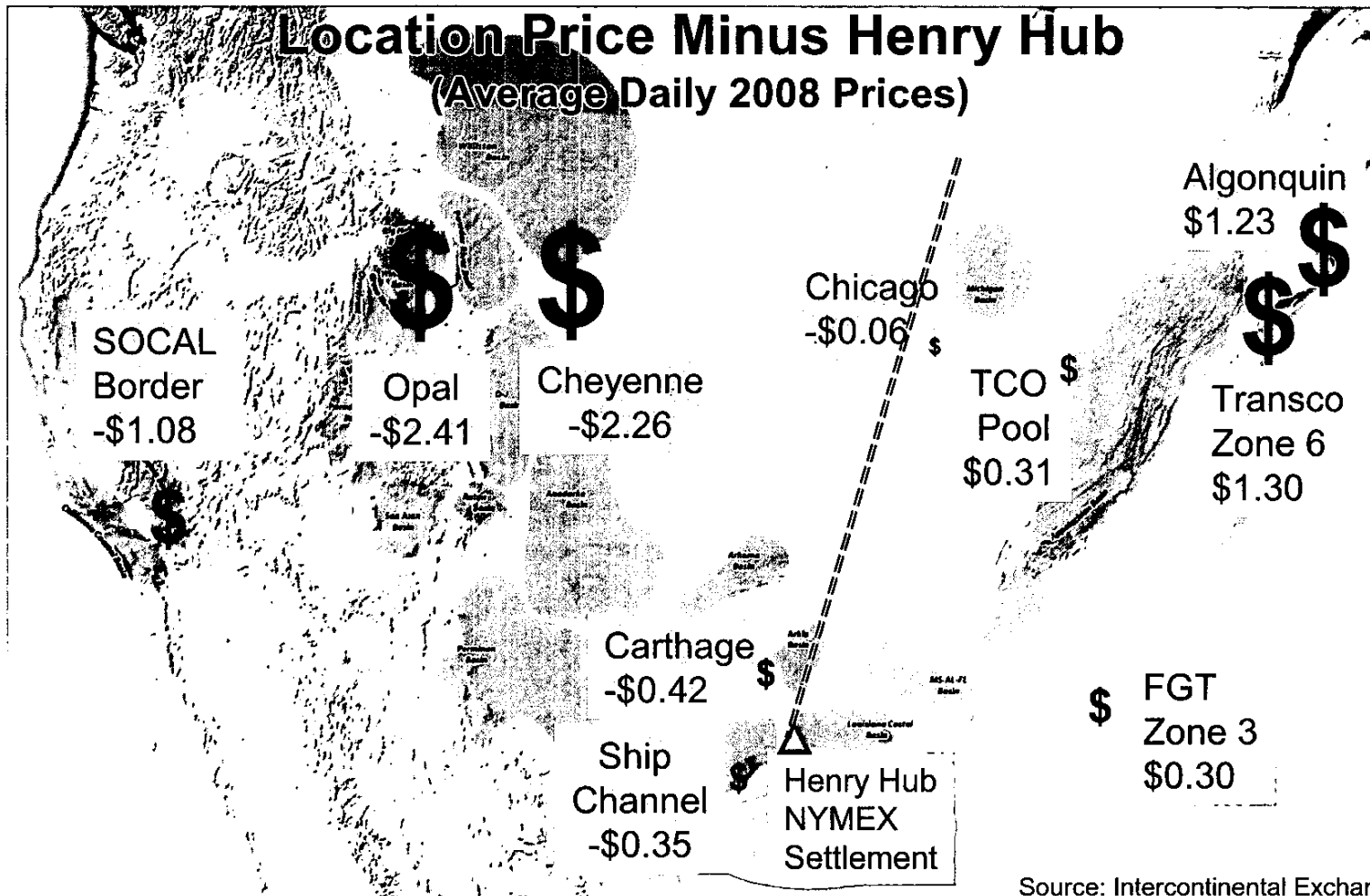


# The Geography of Production Is Changing



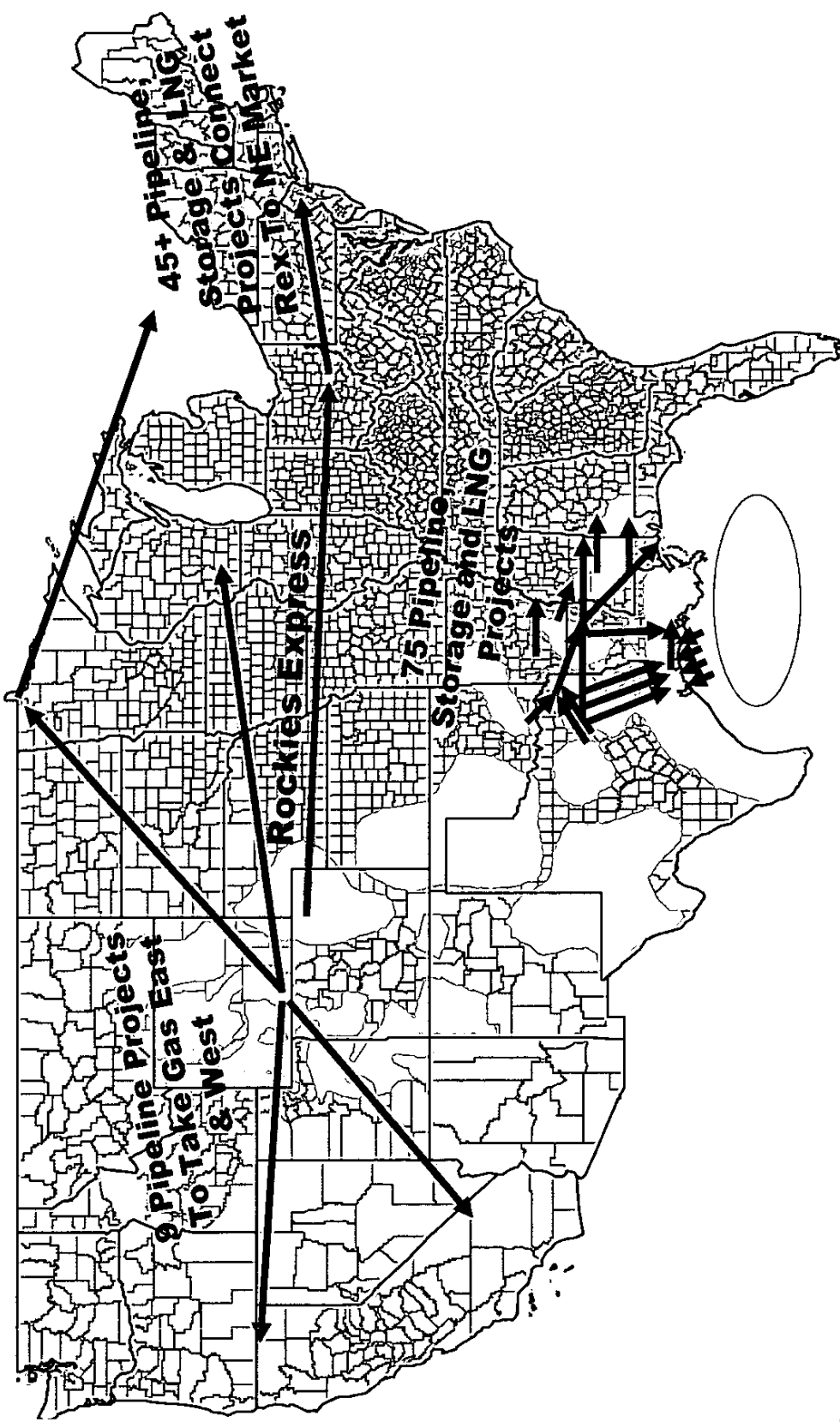
Source: State Oil & Gas  
Commission Reports

# Pipeline Constraints Create Price Anomalies

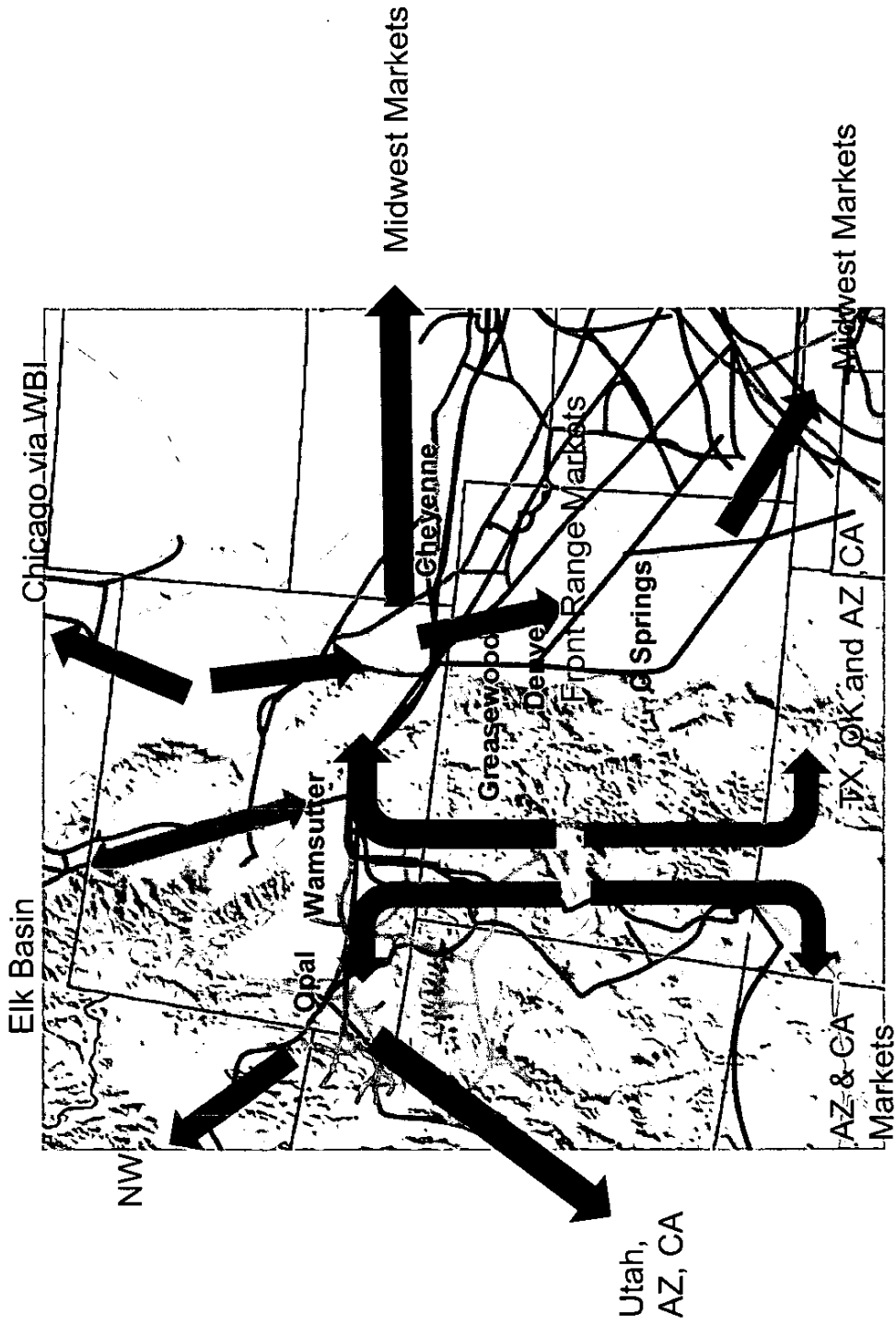


Source: Intercontinental Exchange

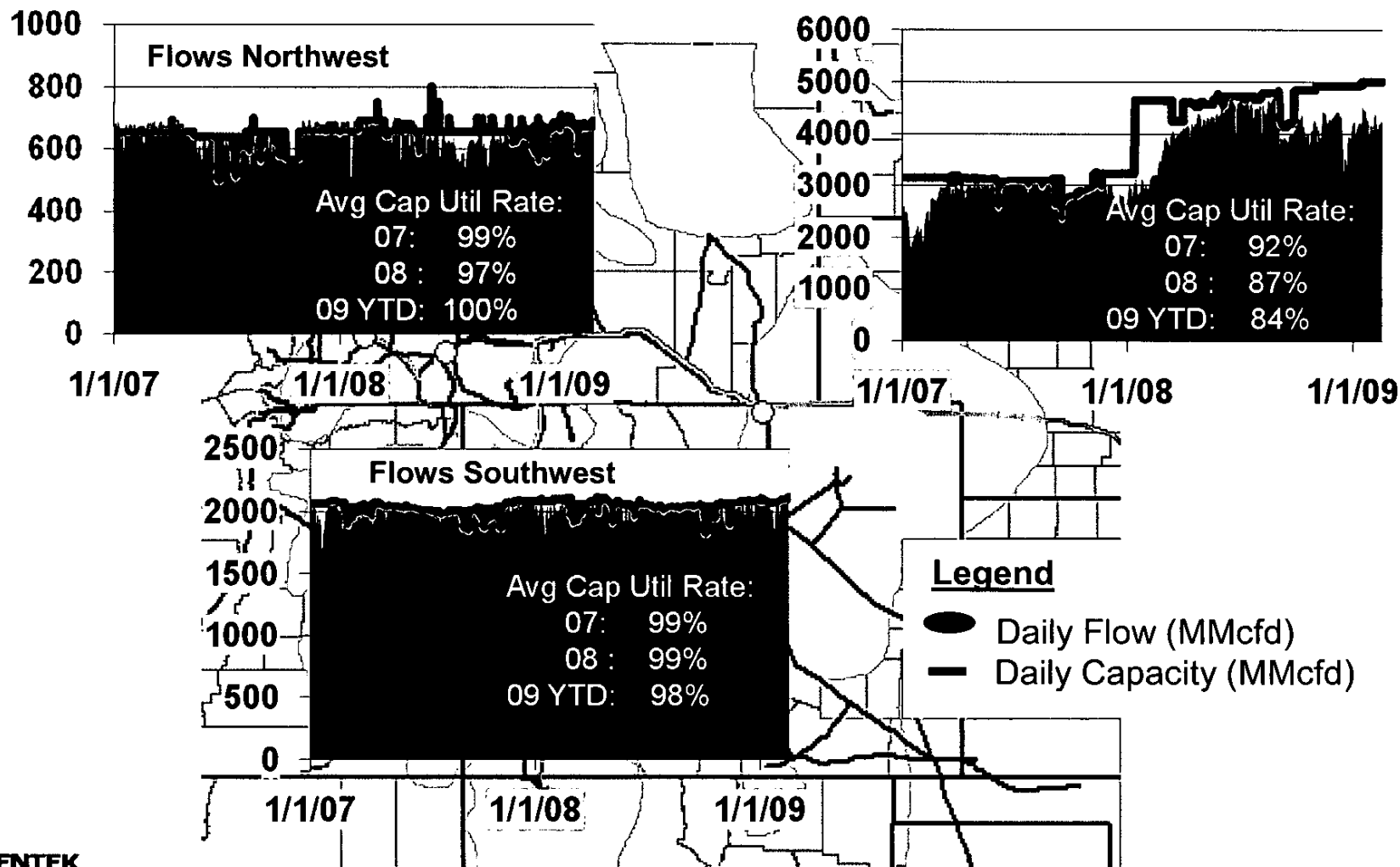
# Billions Are Being Invested To Connect New Production



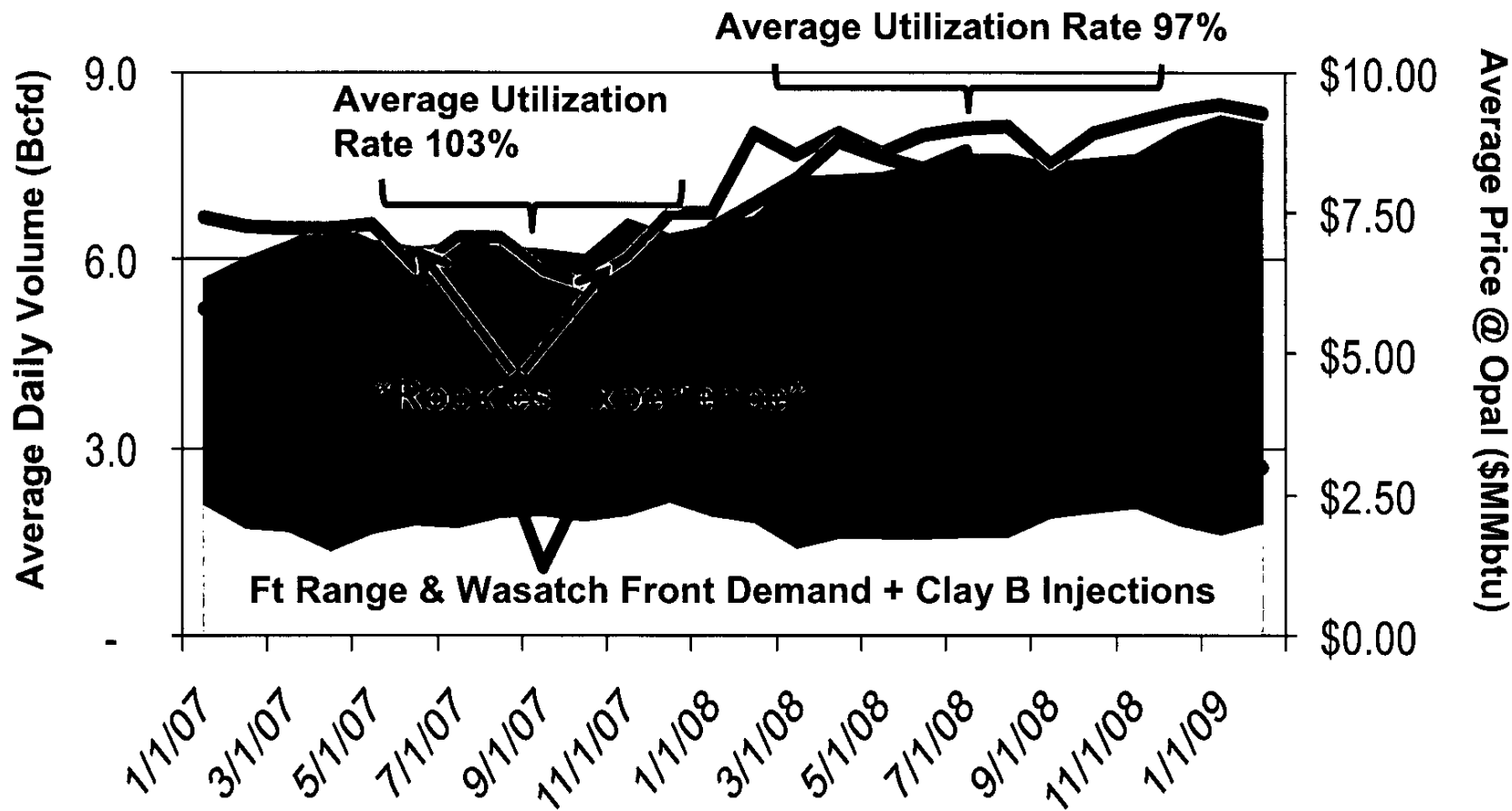
# Rockies Gas Is Mostly For Export



# All Rockies Export Outlets Are Constrained

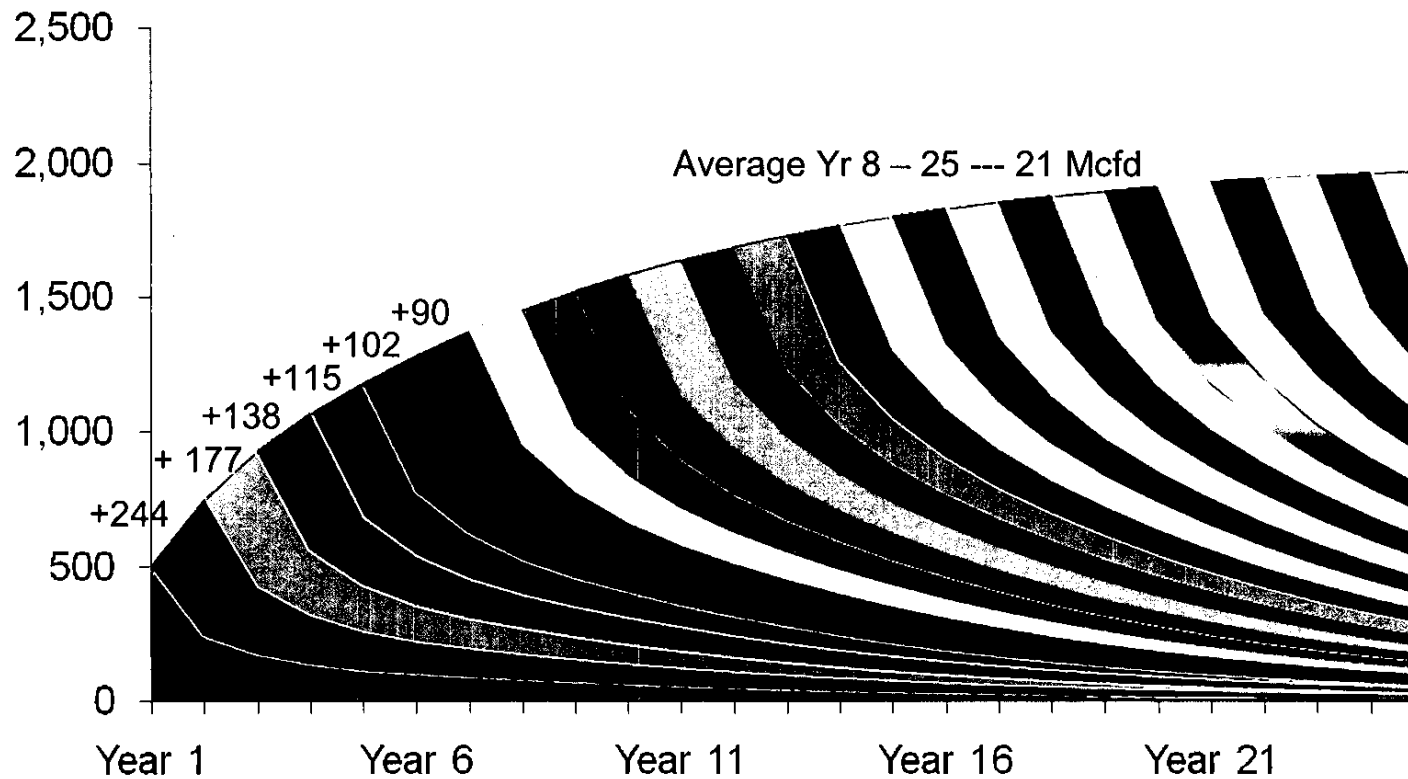


# When Capacity Is Tight, Prices Fall



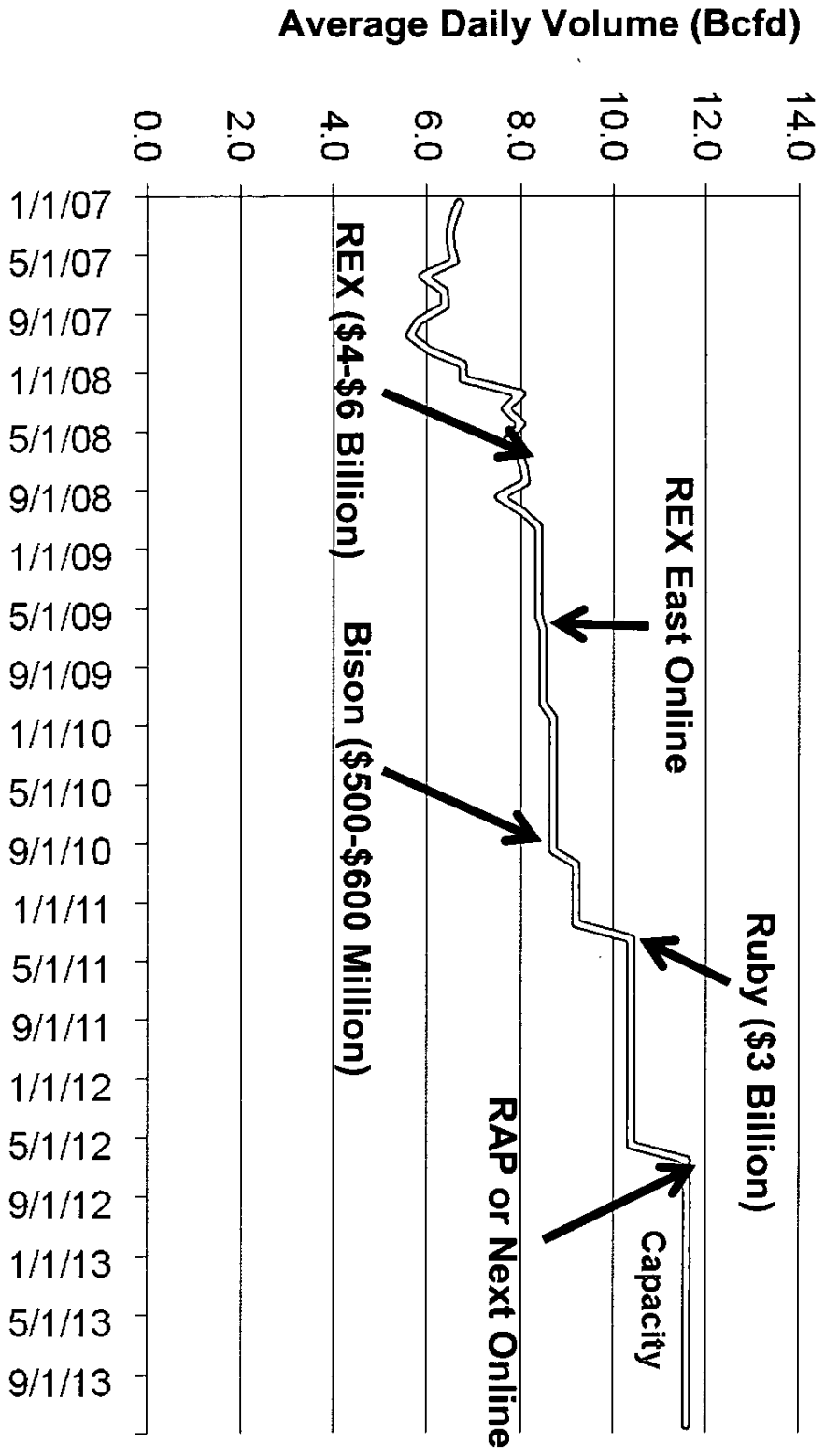
# ***Steep Decline Rates Mean That Each Well Adds Less Incremental Volume***

Average Daily Production From A Mamm Cr Well, Piceance Basin (Mcf/d)



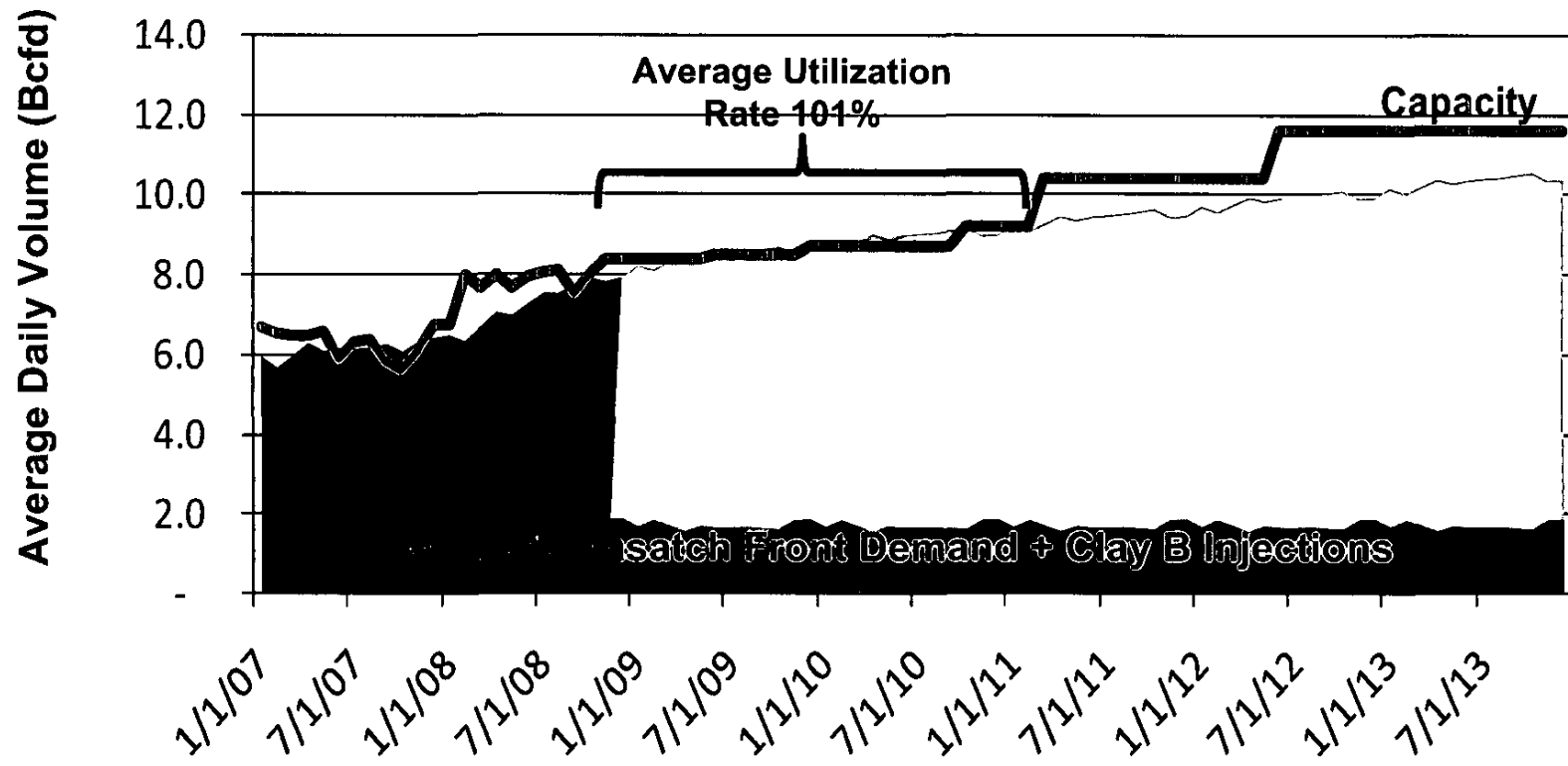
Assumes one well drilled per year

# Rockies Capacity Additions

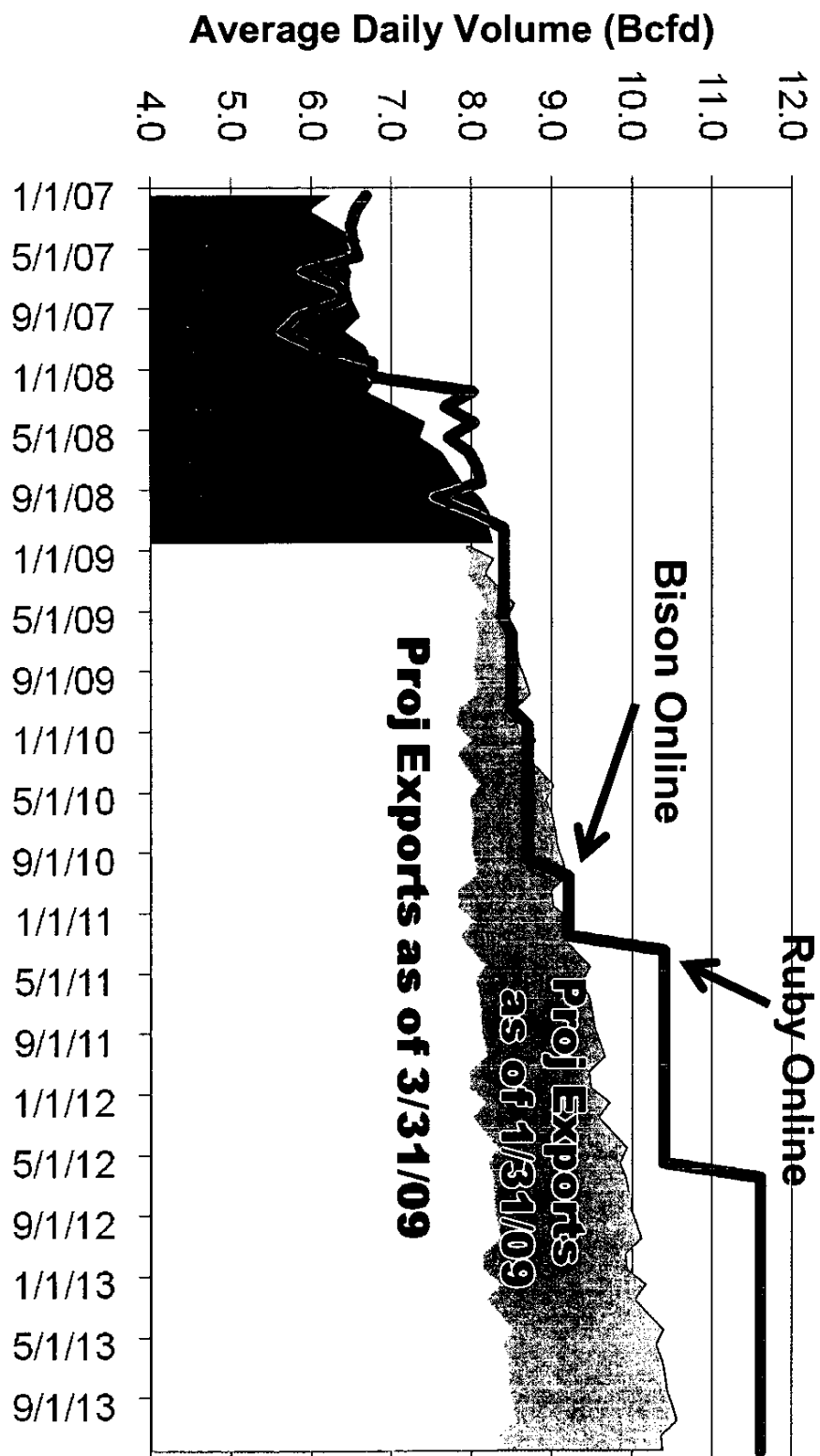


# ***Business As Usual – Prices Too Low To Support Drilling***

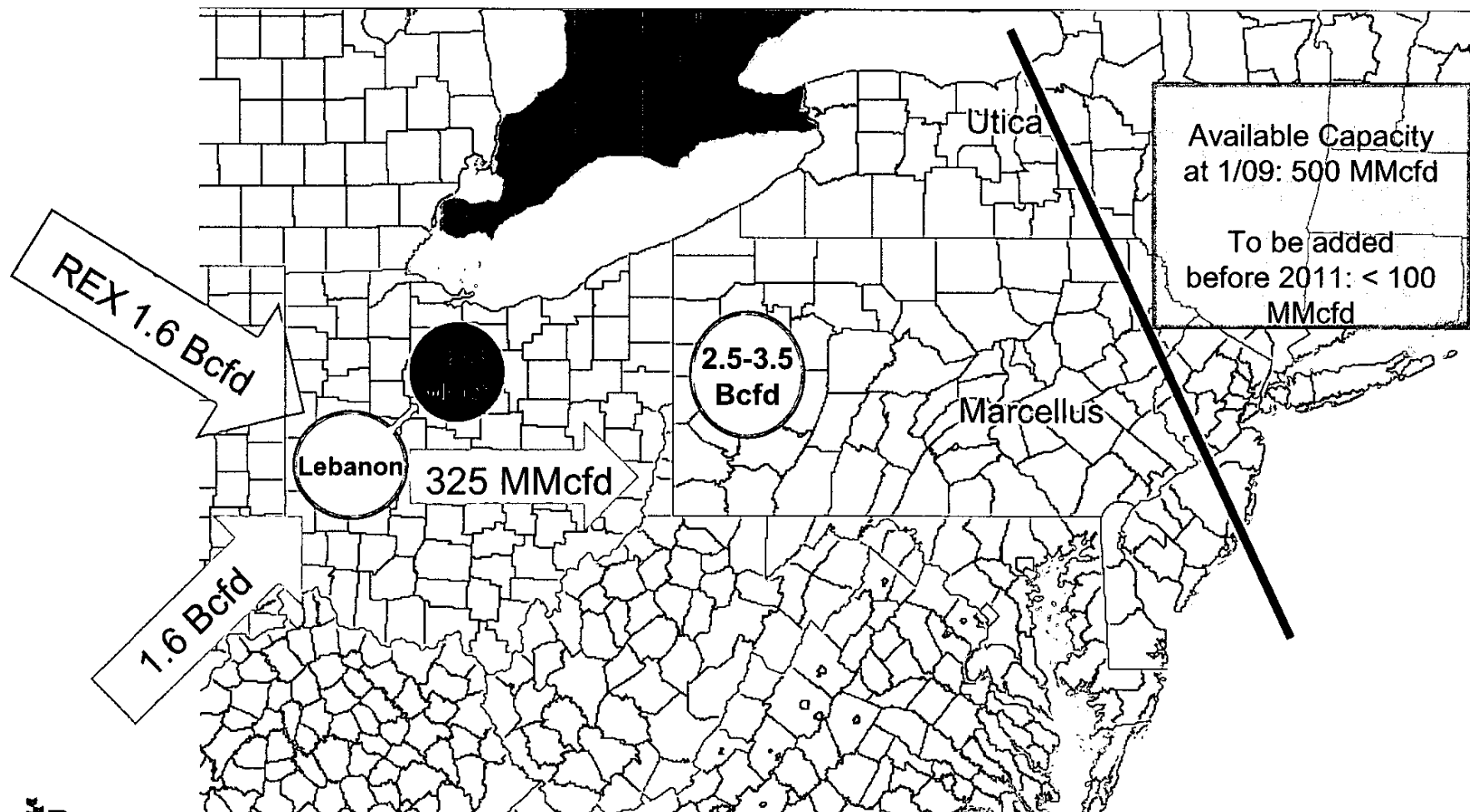
**Assumes Drilling Remains Constant At Dec 08 Rate**



# Drilling Slowdowns Are Aligning Production & Capacity



# ***Constraints Are Developing In The Appalachia Market***

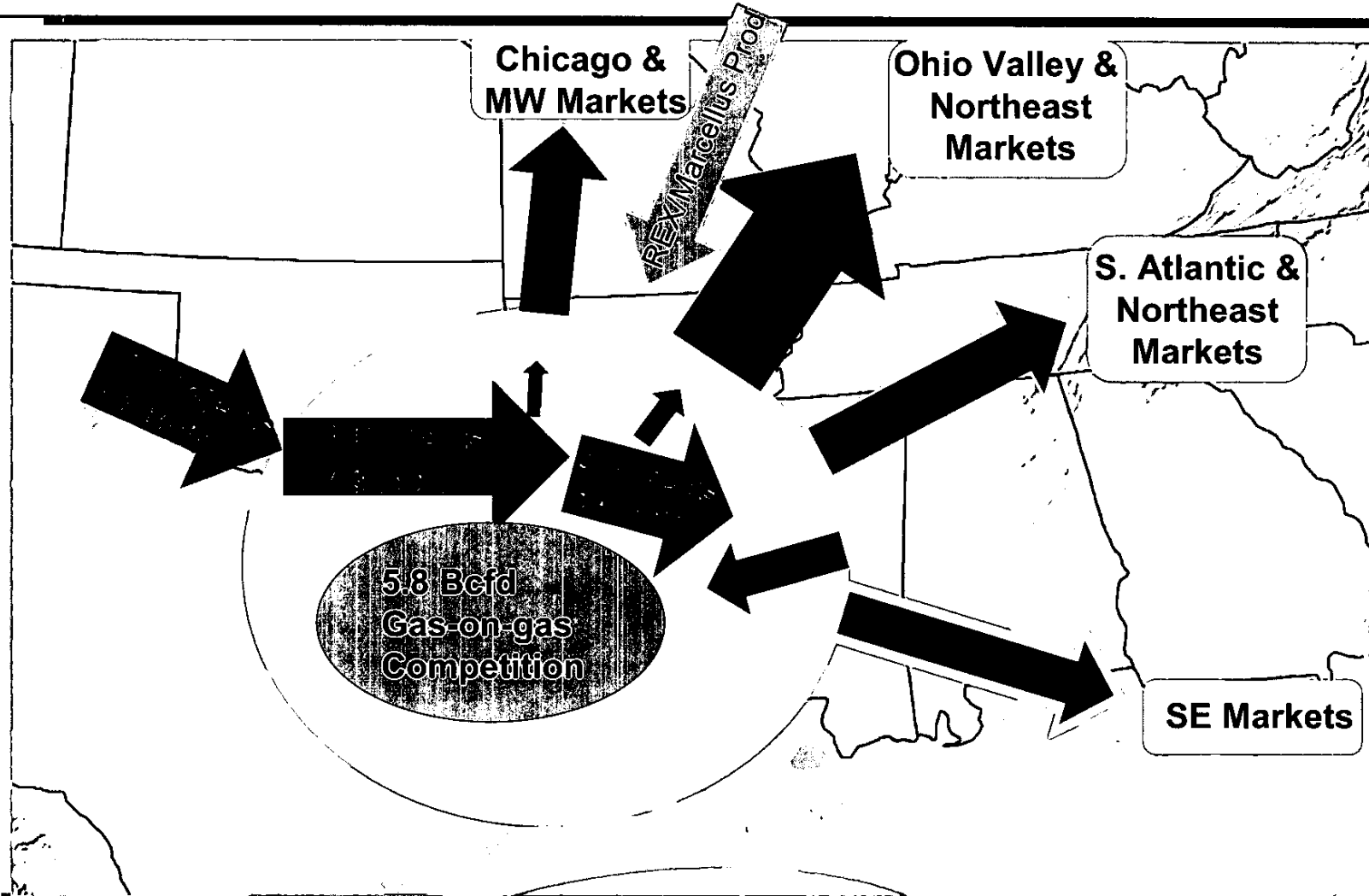


# The Southeast Supply Area Is Complex

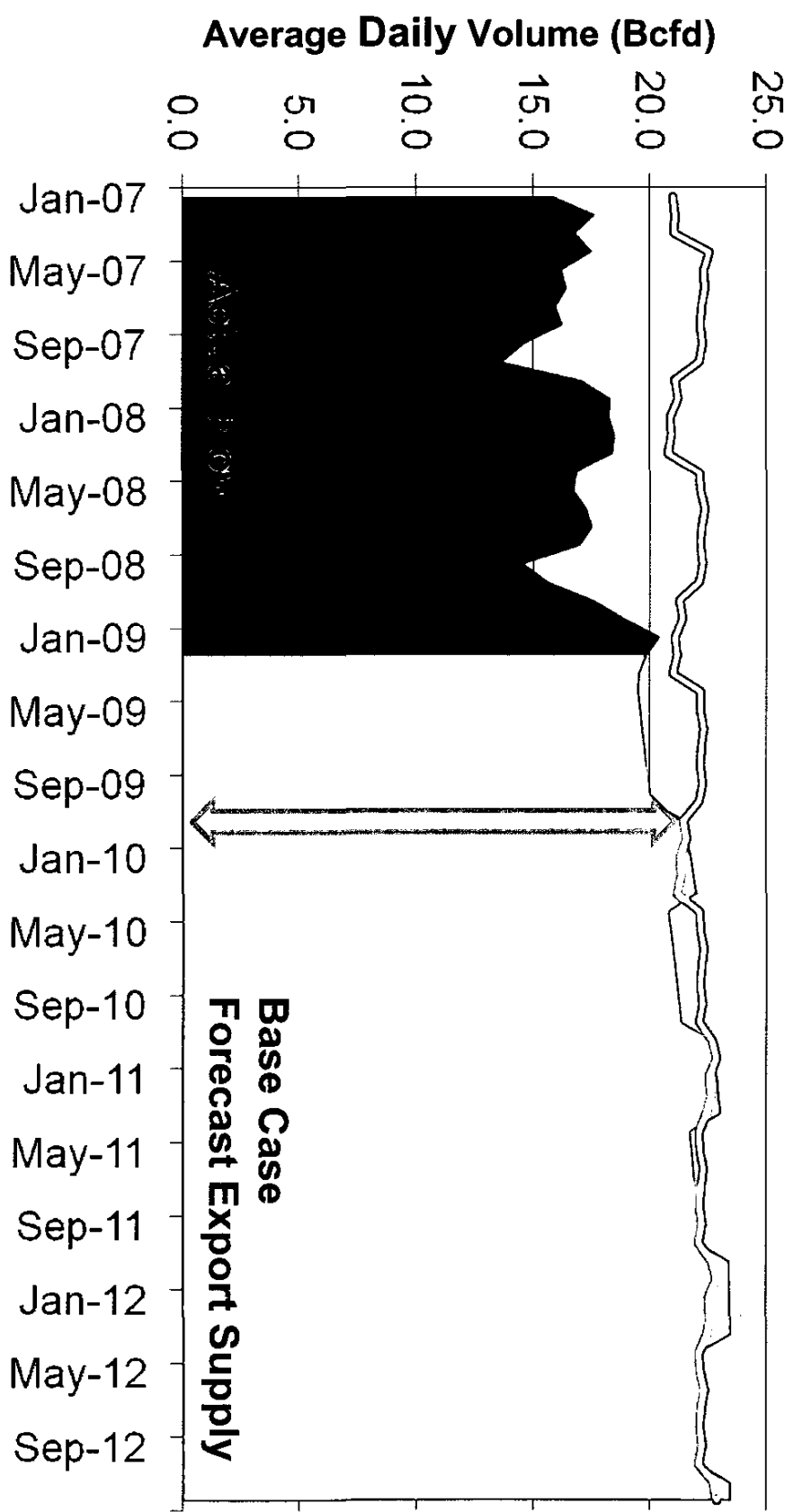
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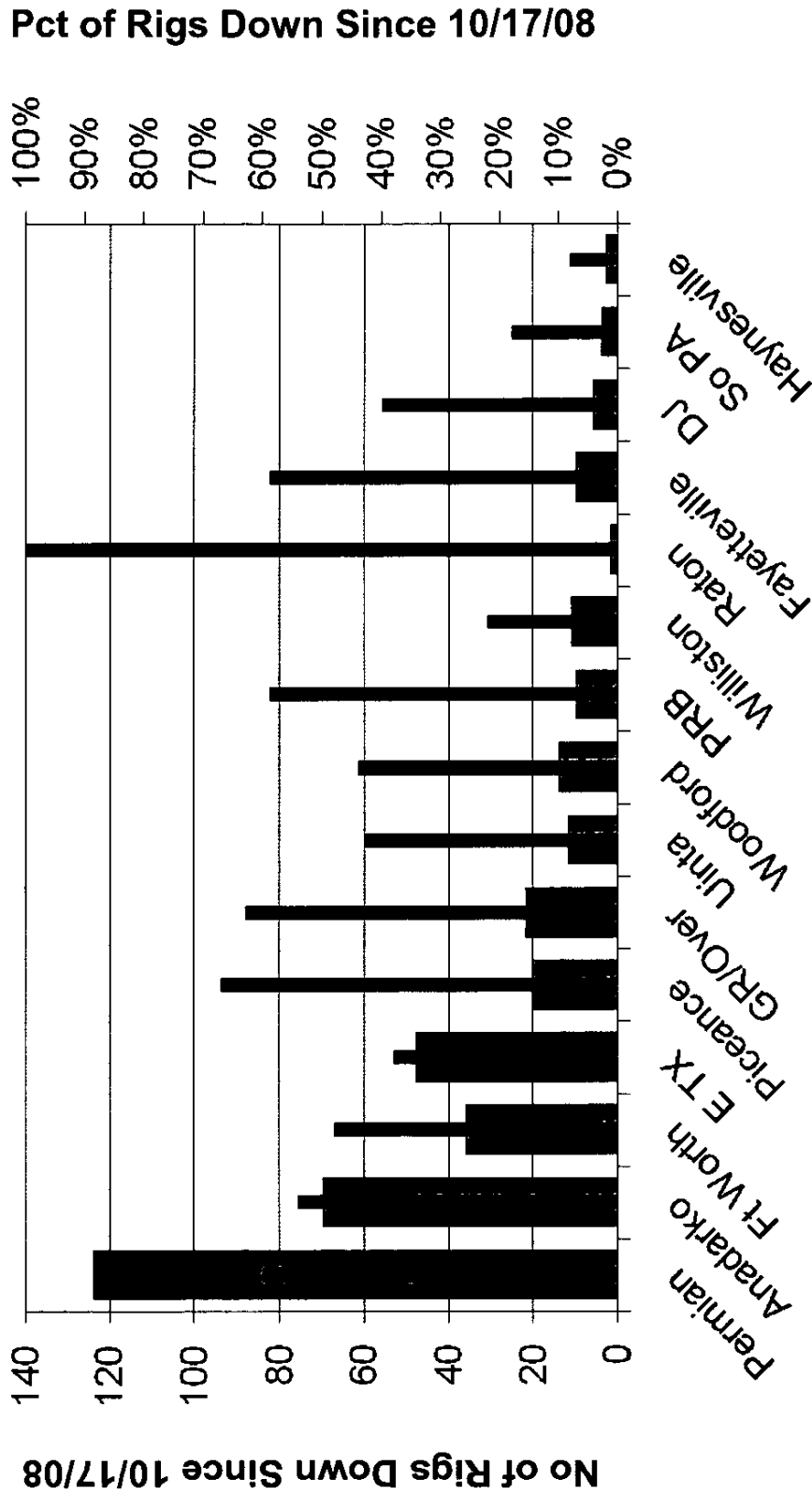
# ***Pipeline Constraints Will Impact The SE Supply Area As Well***



# Drilling May Fall Off Further In The SESA As Well



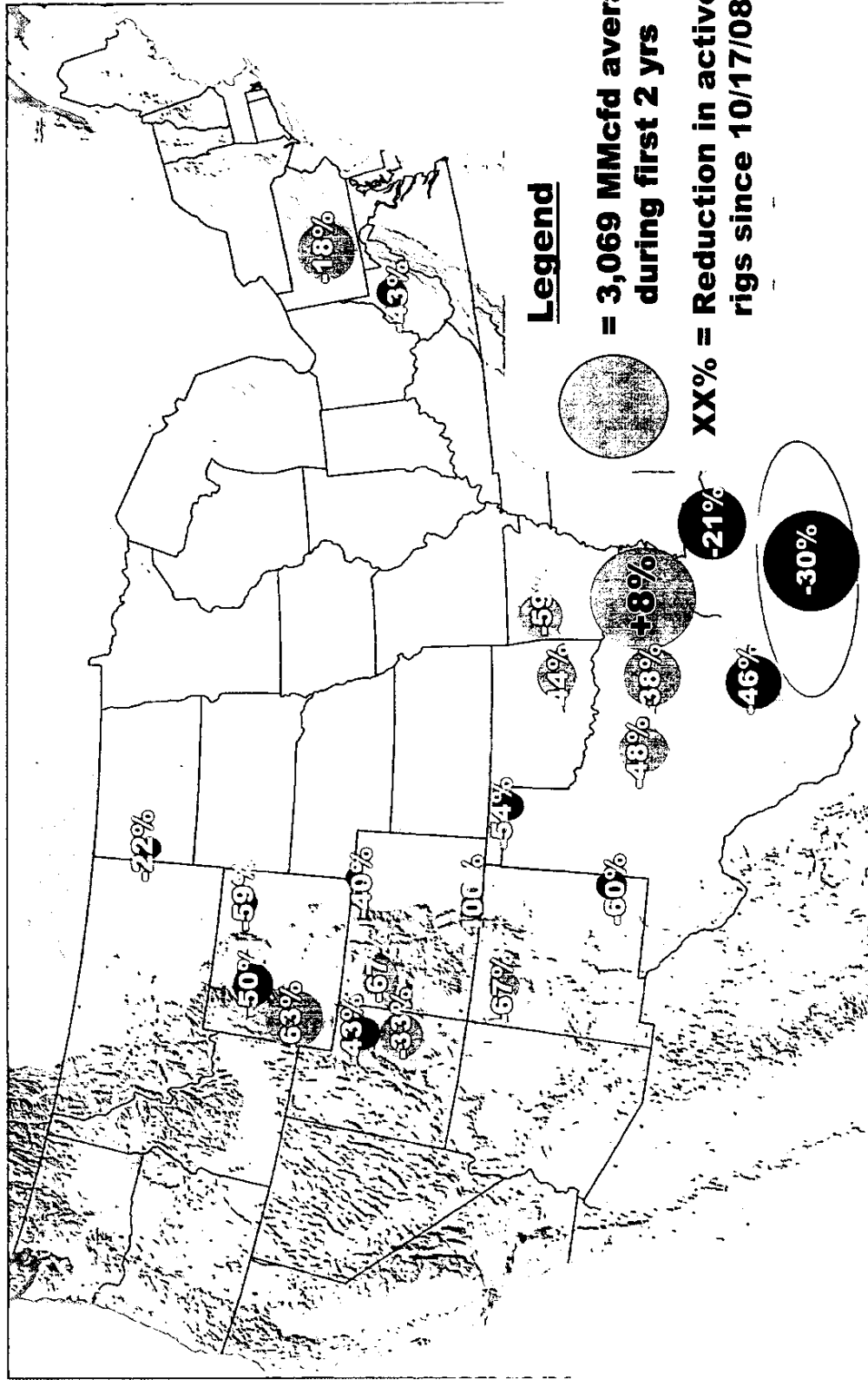
# Drilling Is Off Across The Country



Drilling Data Thru 3/25/2009



# Exploration Is Concentrating In The Most Productive Basins



# ***Conclusions***

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- **Natural gas is the GOOD energy news for consumers.**
- **2008 belied the notion that the US is running out of natural gas. Prices will continue to fall and may stay in the \$3 to \$6 range for many years.**
- **On our current pace:**
  - **Exploration activity will fall dramatically in 2009 from 2008 levels.**
  - **2009 drilling declines will arrest production growth.**
  - **Because of technology and pipeline constraints, prices will continue to be volatile, but corrections will happen more quickly and the range narrower.**
  - **Additional pipe capacity is needed but increased demand must come first .**

# ***Implications***

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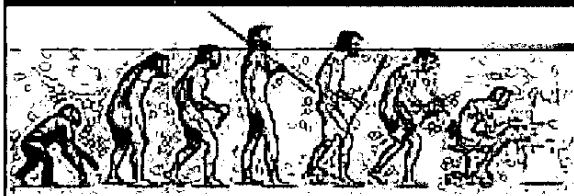
- **The low cost of natural gas will make alternatives economically less competitive .**
  
- **We are faced with an historic opportunity: US gas supplies are sufficient to play the central role in our nation's energy policy:**
  - **It is abundant in the US**
  - **It is relatively cheap**
  - **It is relatively clean**
  - **It is N. American – it provides jobs and tax base**
  - **Its consumption technologies are proven**
  
- **State, local and federal government policy is critical to realizing this fragile opportunity.**
  
- **Government policy – whether state, federal or local – needs a feedback loop to accommodate market changes. Ultimately markets prevail.**

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# ***Alaska's Natural Gas – Needed or Not? What About Shale Gas and Carbon Regulation?***

# AGIA

→ The Alaska Gasline Inducement Act ←



**Dr. Mark Myers  
April 8, 2009**

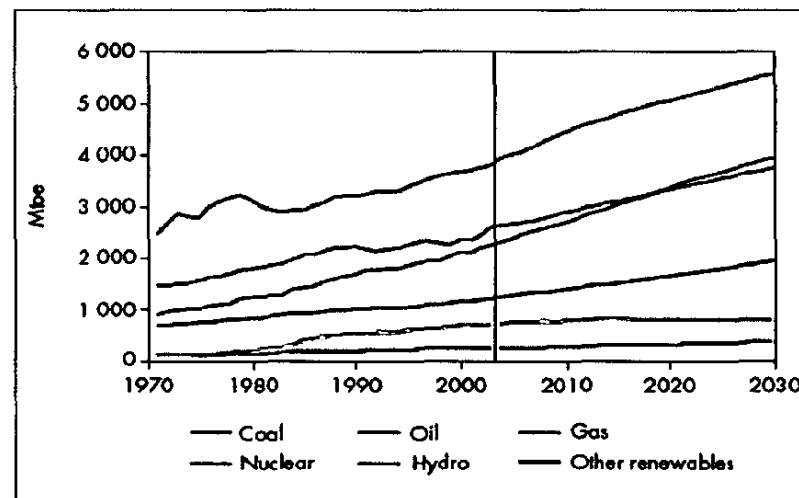
***Alaska's Natural Gas is America's  
Resource For Enhancing Economic,  
Environmental and National Security***

**AGIA**

The Alaska Gasline Inducement Act

- Global competition for imported energy
- Growing population, long term economic growth heighten worldwide demand
- Environmental consequences of development, extraction, and use of other resources

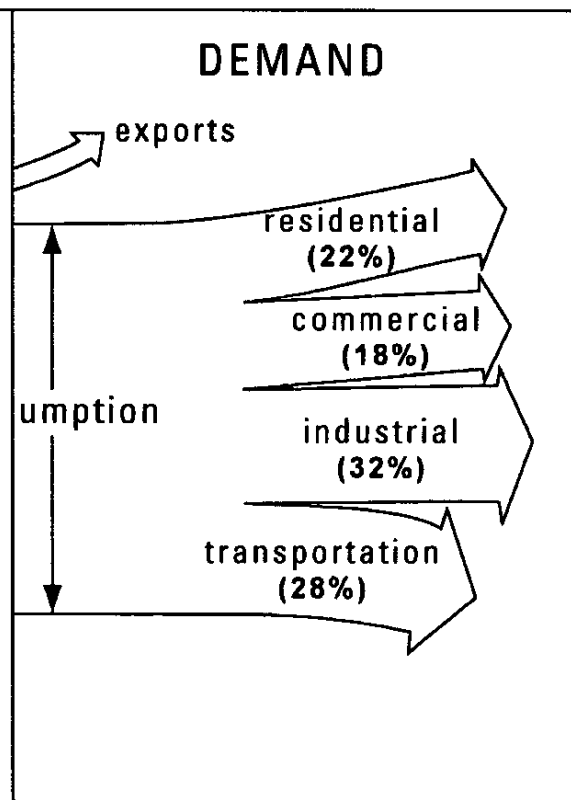
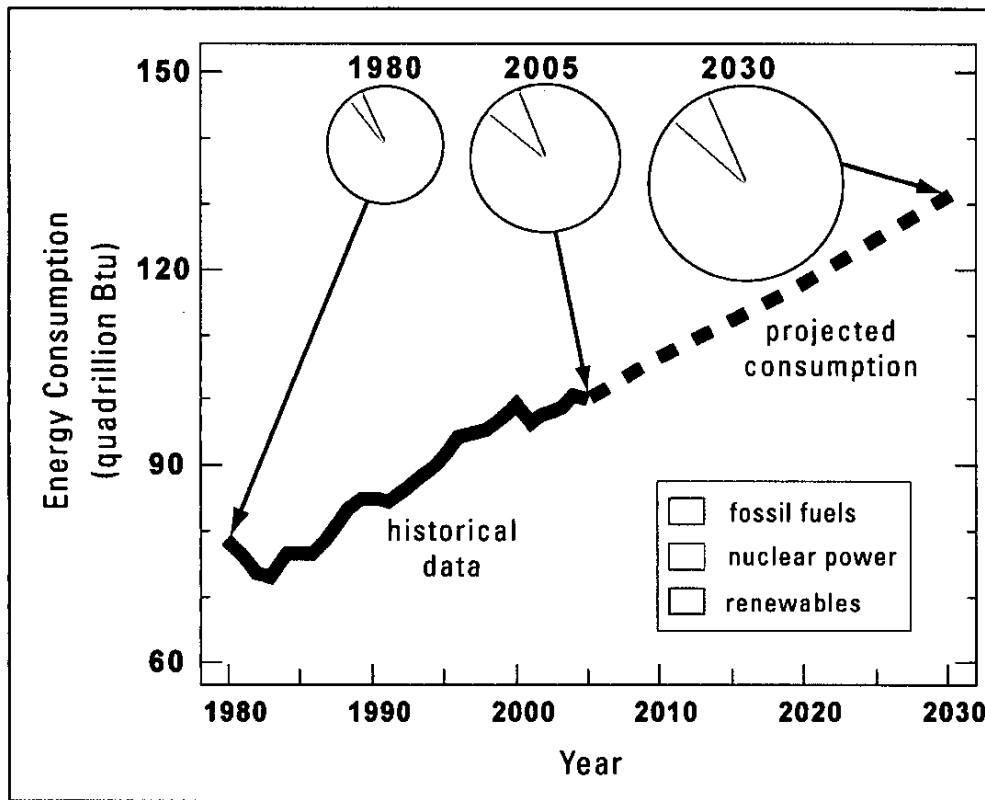
World Energy  
Consumption by  
Source



# The Energy Mix for the United States

# AGIA

The Alaska Gasline Inducement Act



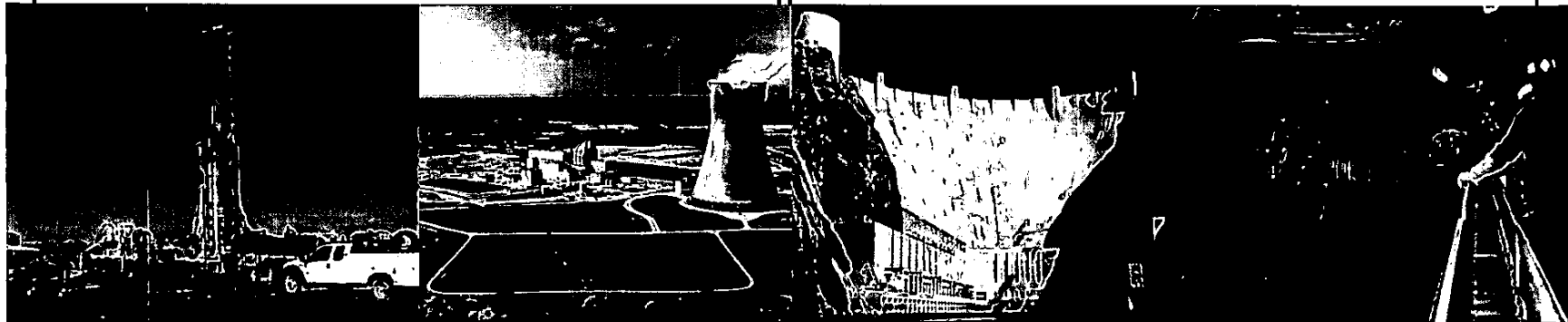
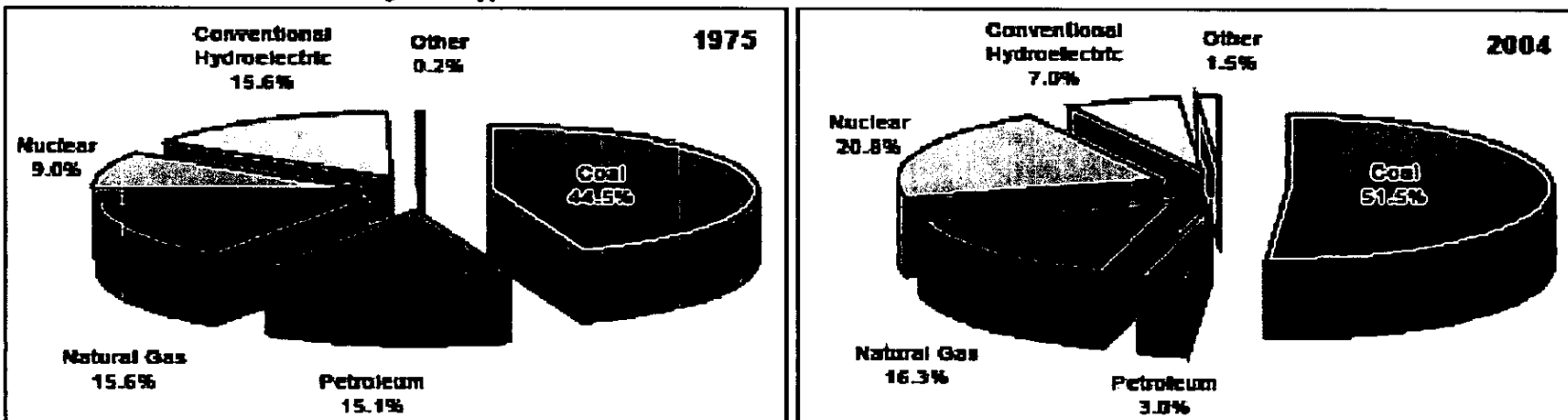
EIA  
3

# Large Changes Have Occurred In Fuel Sources

# AGIA

The Alaska Gasline Inducement Act

U.S. Electric Power Generation by Fuel Type - Years 1975 and 2004



USGS/EIA

Change in Fuel Type for Electrical Generation Over Three Decades

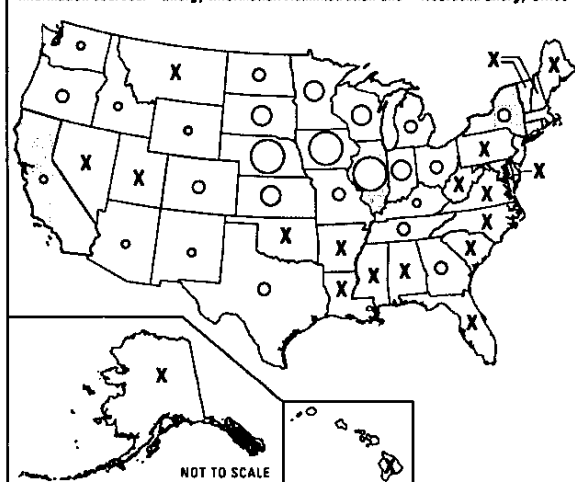
# No Free Lunch: All New Sources of Energy Have Their Own Unique Environmental Challenges: Biomass/Water

# AGIA

USGS/EIA

The Alaska Gasline Inducement Act

Information sources: \*Energy Information Administration and \*\*Nebraska Energy Office



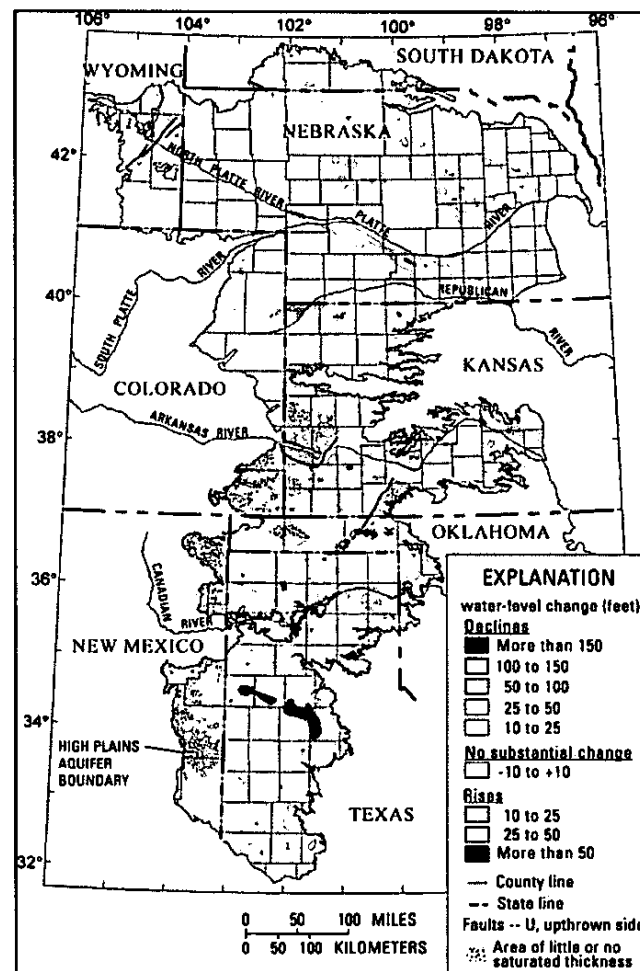
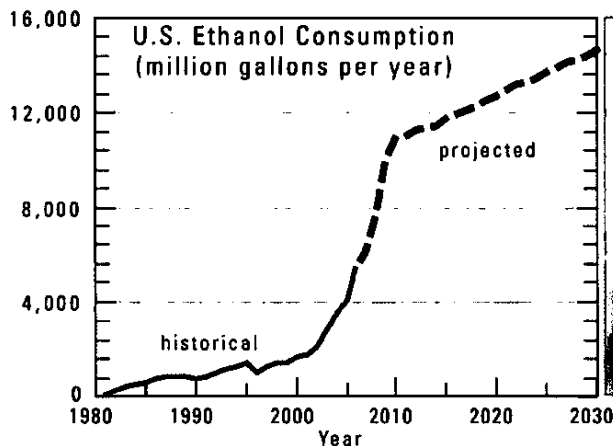
February 2007 - Ethanol Production Capacity\*\* (million gallons per year)

- X no capacity reported
- less than 100
- 100 to 500
- 500 to 1,000
- greater than 1,000

Total U.S. Capacity: 11,800 million gallons per year

2005 Ethanol Consumption Estimates<sup>A</sup> (million gallons)

- none reported
- less than 30
- 30 to 100
- 100 to 300
- greater than 300



# *The USA Today*

# AGIA

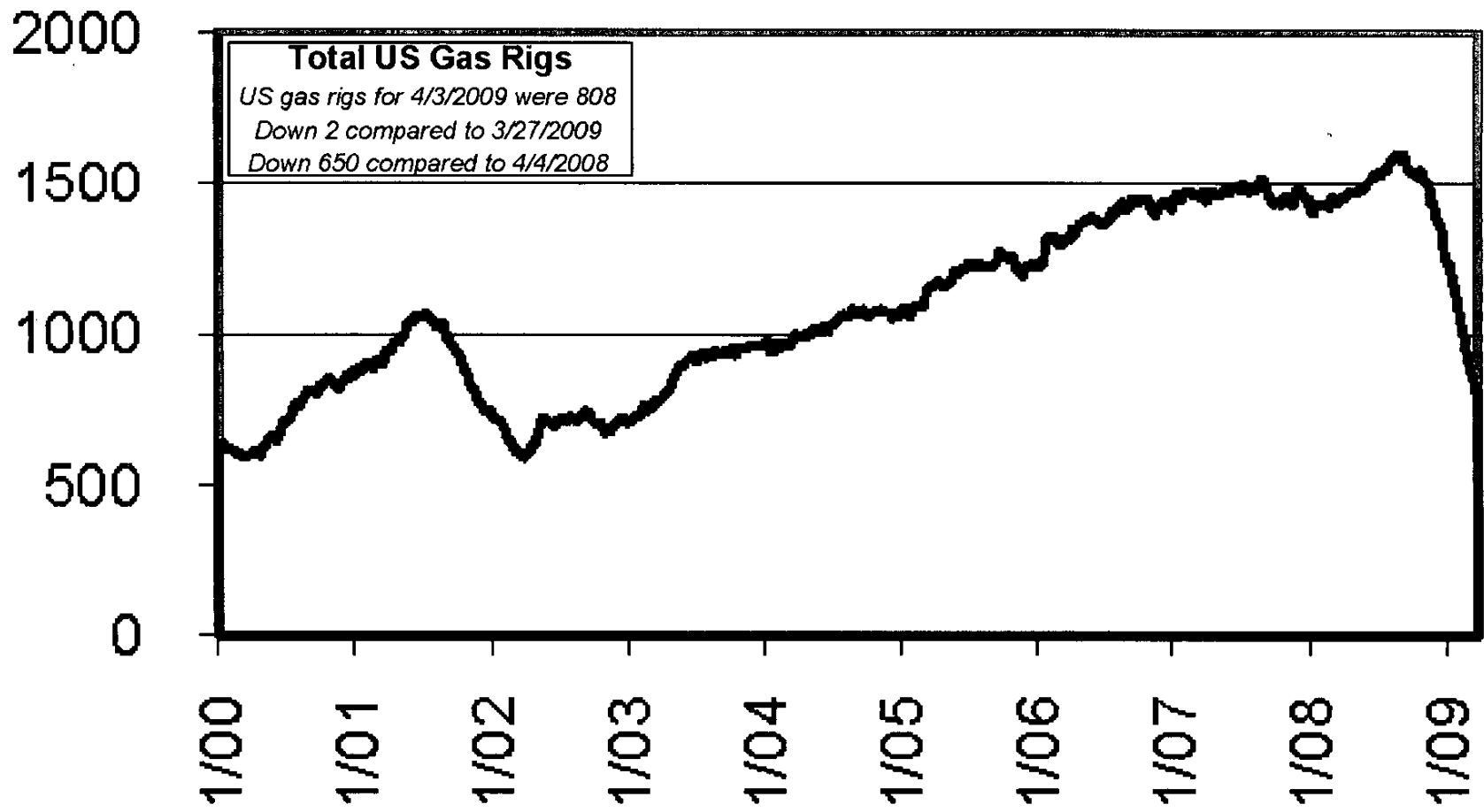
The Alaska Gasline Inducement Act

- How have things changed since the legislature approved the AGIA license?
  - Global economic downturn with associated rapid decline in oil and gas prices
  - Rapid expansion of unconventional (shale) gas supplies in USA
  - Policy shift limiting access to lower 48 federal lands for non-renewable energy production?
  - First authoritative Arctic oil and gas assessment
  - Increased likelihood of carbon regulation

# U.S. Gas Well Drilling down 45% in Last Year

# AGIA

The Alaska Gasline Inducement Act



Source: Baker Hughes

# ***Economic 'Recession'*** **AGIA**

The Alaska Gasline Inducement Act

**Jim Mulva, Chairman and CEO ConocoPhillips,  
March 13, 2009 - *Petroleumworld.com***

*"Costs are coming down pretty dramatically," (Mulva) said. "When we say defer, we're not talking years, we're talking months, quarters, maybe up to a year."*

*Speaking about the Denali Alaska gas pipeline project, proposed last June by ConocoPhillips and BP, Mulva said President Barack Obama has identified the 4 Bcf/d project as a means of reducing US dependence on foreign oil.*

*The pipeline would bring North Slope gas down to a pipeline in Alberta for transport to the Lower 48 states. "We know it's going to get far more federal attention," he said. "Obviously, Alaska would like to see it go."*

*Mulva repeated the partners plan a 2010 open season for gas deliveries; first gas deliveries are eyed for 2019.*

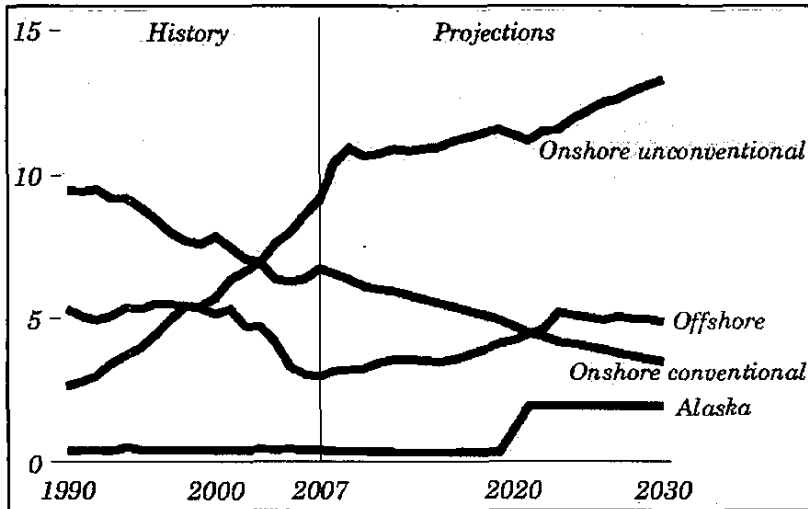
*While current gas prices have led ConocoPhillips to cut back on its Canadian operations, Mulva discounted the low prices as a roadblock to the pipeline project's development.*

*"You can't look at gas prices today," he said. "You have to look at prices 10 years from now."*

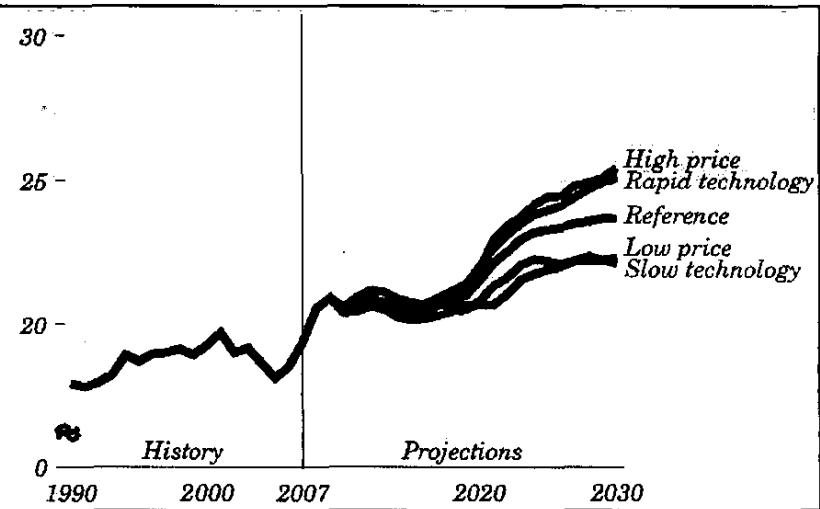
**Both Lower 48 Unconventional and Alaska North Slope Gas are Needed for America's Future**

**AGIA**

The Alaska Gasline Inducement Act



Natural gas production by source, (1990-2030 9trillion cubic feet)

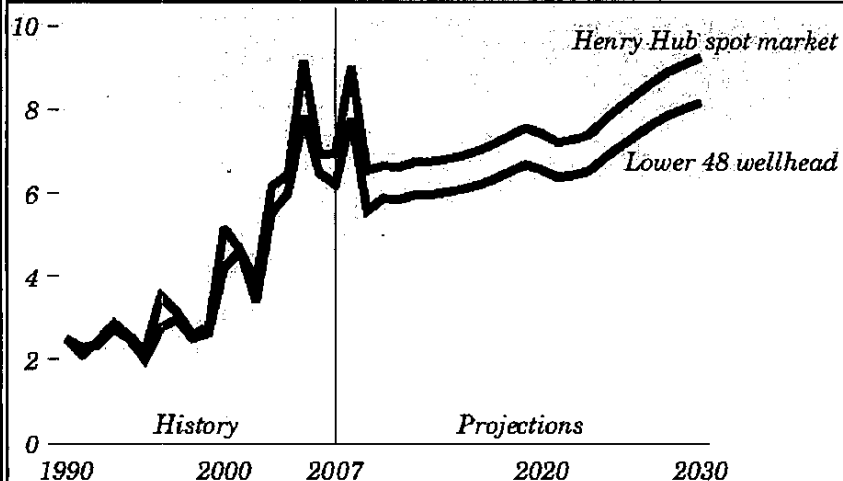


Total U.S. natural gas production in five cases, 1990-2030 (trillion cubic feet)

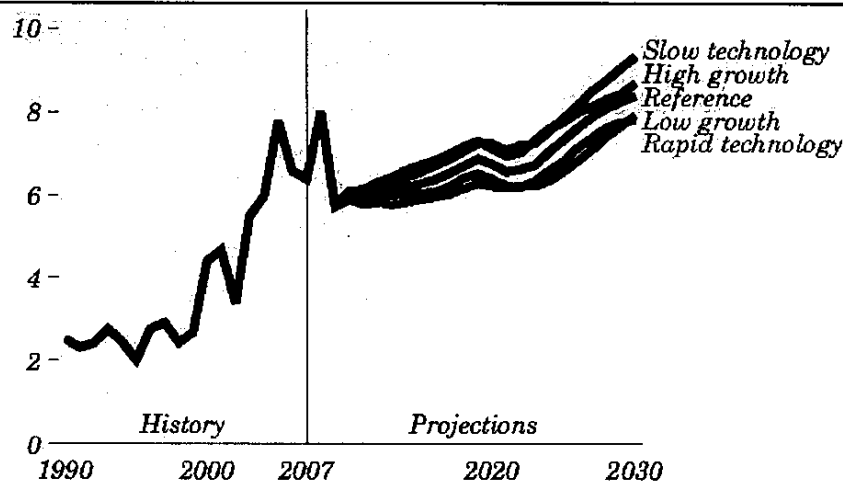
# 2009 EIA Forecasts for Natural Gas Prices Accounts for Growth of Unconventional Gas Resources



The Alaska Gasline Inducement Act



Lower 48 wellhead and Henry Hub Spot market prices for natural gas, 1990-2030 (2007 dollars per million Btu)



Lower 48 wellhead natural gas prices in five cases, 1990-2030 (2007 dollars per thousand cubic feet)

## ***Development of New Unconventional Gas Resources***

# AGIA

The Alaska Gasline Inducement Act

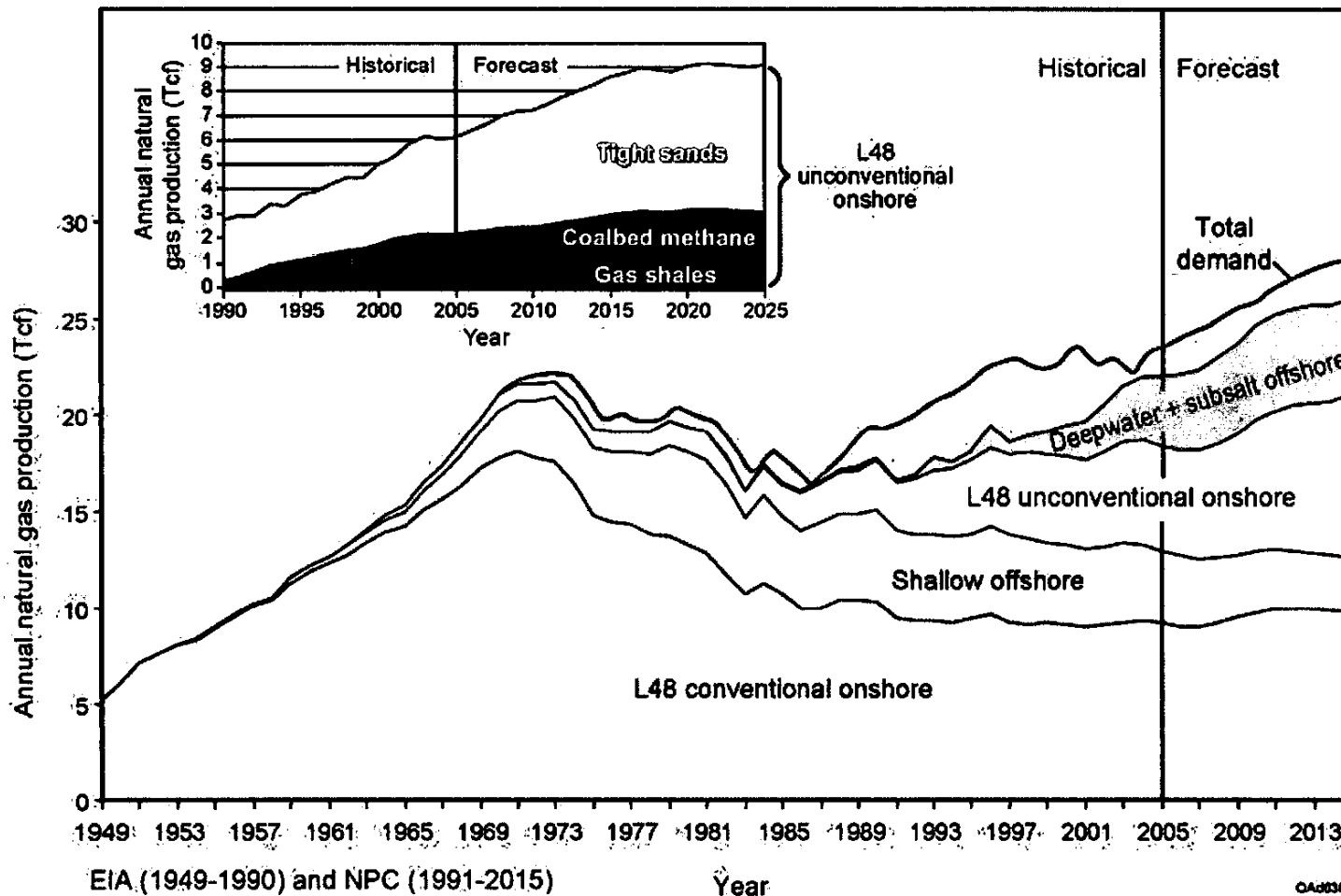
“Declines [in North America] are expected to accelerate after 2030 coinciding with the increase in LNG import volumes. Black & Veatch expects near-term production growth in the Rockies and shale plays to offset declines in the Gulf Coast and other Lower 48 production basins.”

- AGIA Findings and Determination; Appendix G1 – *AGIA NPV Report*

# Shale Gas Provides About 5% of Domestic Production



The Alaska Gasline Inducement Act



EIA (1949-1990) and NPC (1991-2015)

Year

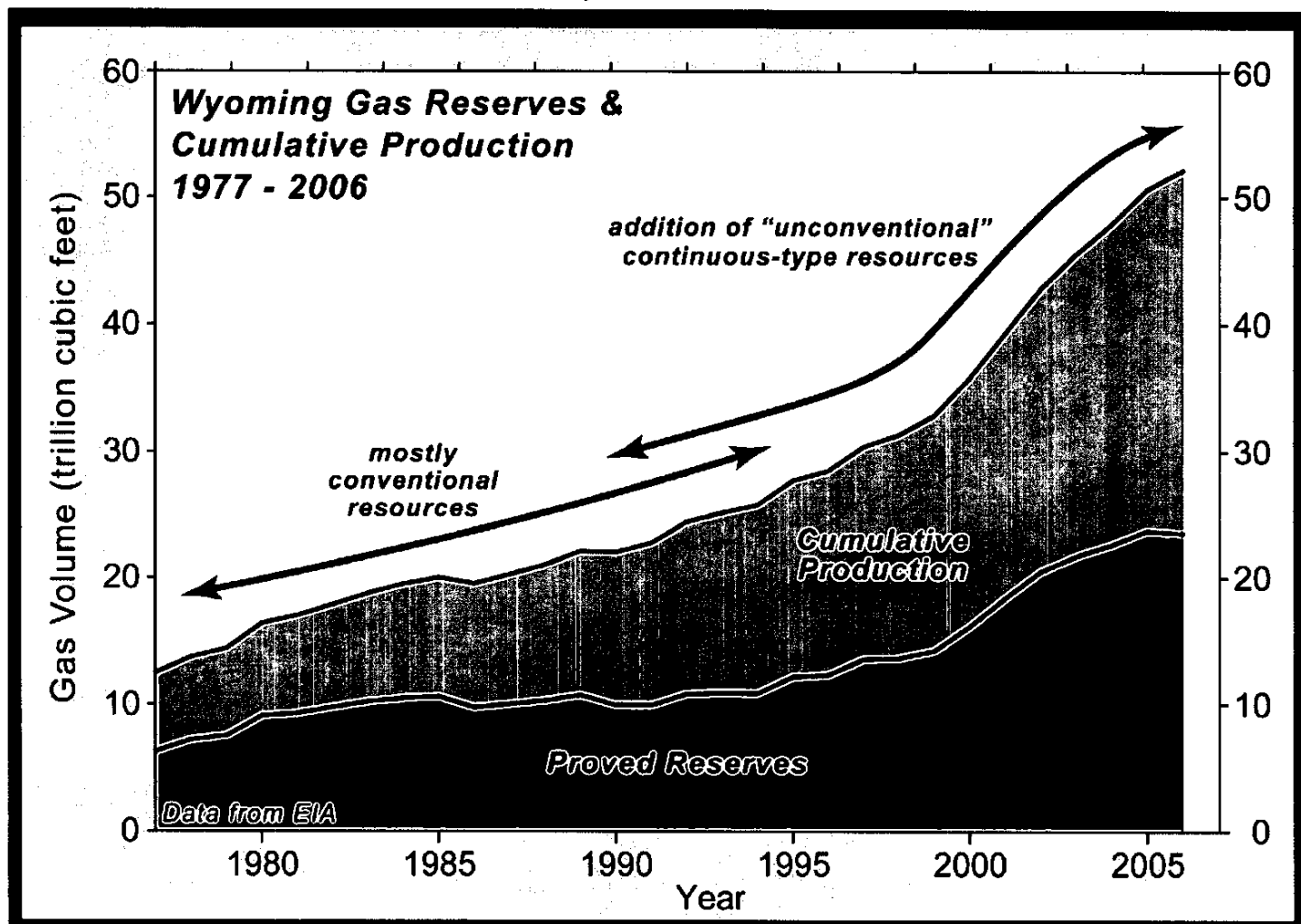
GA0308

# Wyoming Gas Reserves & Production History

# AGIA

The Alaska Gasline Inducement Act

Courtesy of USGS



# Lower 48 Shale Gas Plays

# AGIA

The Alaska Gasline Inducement Act



United States Shale Gas Plays

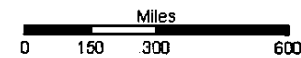
www.eia.doe.gov  
**eia** Energy Information Administration  
 Office of Oil and Gas

Shale Gas Plays  
 Basins

Stacked Appalachian Plays

Marcellus  
 Utica  
 Devonian (OH shale)

November 2008



## ***Estimated Break-Even Costs for Lower 48 Shale Gas and Alaska North Slope Onshore Gas***



The Alaska Gasline Inducement Act

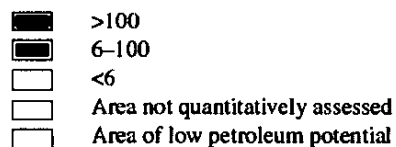
- Onshore North Slope Gas (at AECO Hub)  
\$3.00 - \$4.25  
(USGS, AGIA Finding)
- Lower 48 Shale Gas (NYMEX)  
Lowest - \$4.20  
Medium - \$6.64  
Highest - \$11.50  
(Bank of America)
- Today's lower drilling and steel costs and future technological development enhance economics of BOTH

# Arctic Alaska and Russia at the Top

# AGIA

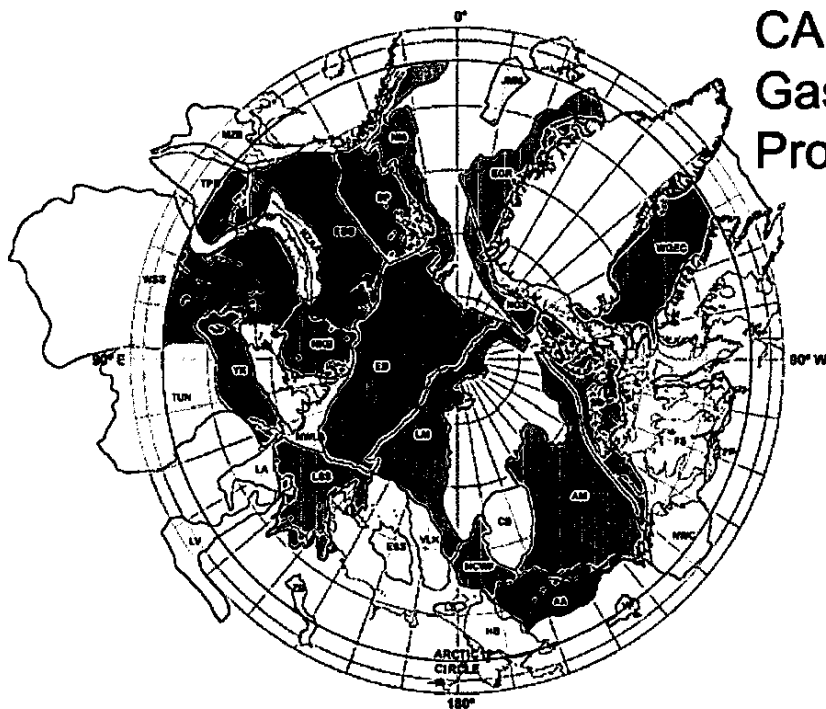
The Alaska Gasline Inducement Act

## UNDISCOVERED GAS (trillion cubic feet)



Province Code	Province	Oil (MMBO)	Total Gas (BCFG)	NGL (MMBNGL)	BOE (MMBOE)
WSB	West Siberian Basin	6,059.00	691,400.00	90,228.60	132,571.66
AA	Arctic Alaska	29,960.94	221,397.60	5,904.97	72,765.52
EBB	East Barents Basin	7,406.48	217,557.00	1,408.60	61,755.10
EGR	East Greenland Rift Basins	8,902.13	86,180.06	8,121.57	31,387.04
YK	Yanisey-Khatanga Basin	5,583.74	99,964.26	2,675.15	24,919.61
AM	Amerasia Basin	9,723.58	56,891.21	541.69	19,747.14
WGEC	West Greenland-East Canada	7,274.40	51,818.16	1,152.59	17,063.35
WSB	Arctic Shelf	3,115.57	32,562.84	887.16	9,409.87
WSB	Arctic Margin	1,437.29	32,281.01	504.73	7,322.19
WSB	Arctic Platform	2,055.51	26,218.67	278.71	6,704.00
WSB	Arctic Basin	1,342.15	19,475.43	520.26	5,108.31
WSB	Arctic Basins and Platforms	1,807.26	14,973.58	390.22	4,693.07
WSB	Arctic Thorsen Basin	1,667.21	9,062.59	202.80	3,380.44
WSB	Arctic Greenland Sheared Margin	1,349.80	10,207.24	273.09	3,324.09
WSB	Arctic Makarov	1,106.78	7,156.25	191.55	2,491.04
WSB	Arctic Basin	851.11	8,596.36	191.20	2,475.04
WSB	Arctic Bar Basin	1,912.89	2,106.75	56.41	2,320.43
WSB	Arctic Ikchi-Wrangell Foreland	85.99	6,065.76	106.57	1,203.52
WSB	Arctic Basin	98.03	5,741.87	101.63	1,156.63
WSB	Arctic Laptev Sea Shelf	172.24	4,488.12	119.63	1,039.90
WSB	Arctic GIN Basin	376.86	1,335.20	35.66	635.06
WSB	Arctic Basin	47.82	1,505.99	40.14	338.95
WSB	Arctic GIN Sea Basin	19.73	618.83	10.91	133.78
WSB	Arctic Basin	2.47	648.17	11.37	121.87
WSB	Arctic Canada Interior Basins	23.34	305.34	15.24	89.47
WSB	Arctic Basin	NQA	NQA	NQA	NQA
WSB	Arctic Timiya Basins and Admiralty	NQA	NQA	NQA	NQA
WSB	Arctic Basin	NQA	NQA	NQA	NQA
WSB	Arctic Borderland	NQA	NQA	NQA	NQA
WSB	Arctic Basins (part of Central Alaska)	NQA	NQA	NQA	NQA
WSB	Arctic Basin (ce)	NQA	NQA	NQA	NQA
WSB	Arctic Basin	NQA	NQA	NQA	NQA
WSB	Arctic Basin Microcontinent	NQA	NQA	NQA	NQA
WSB	Arctic Basin Shelf	NQA	NQA	NQA	NQA
		89,983.21	1,668,657.84	44,064.24	412,157.09

## CARA Gas Provinces



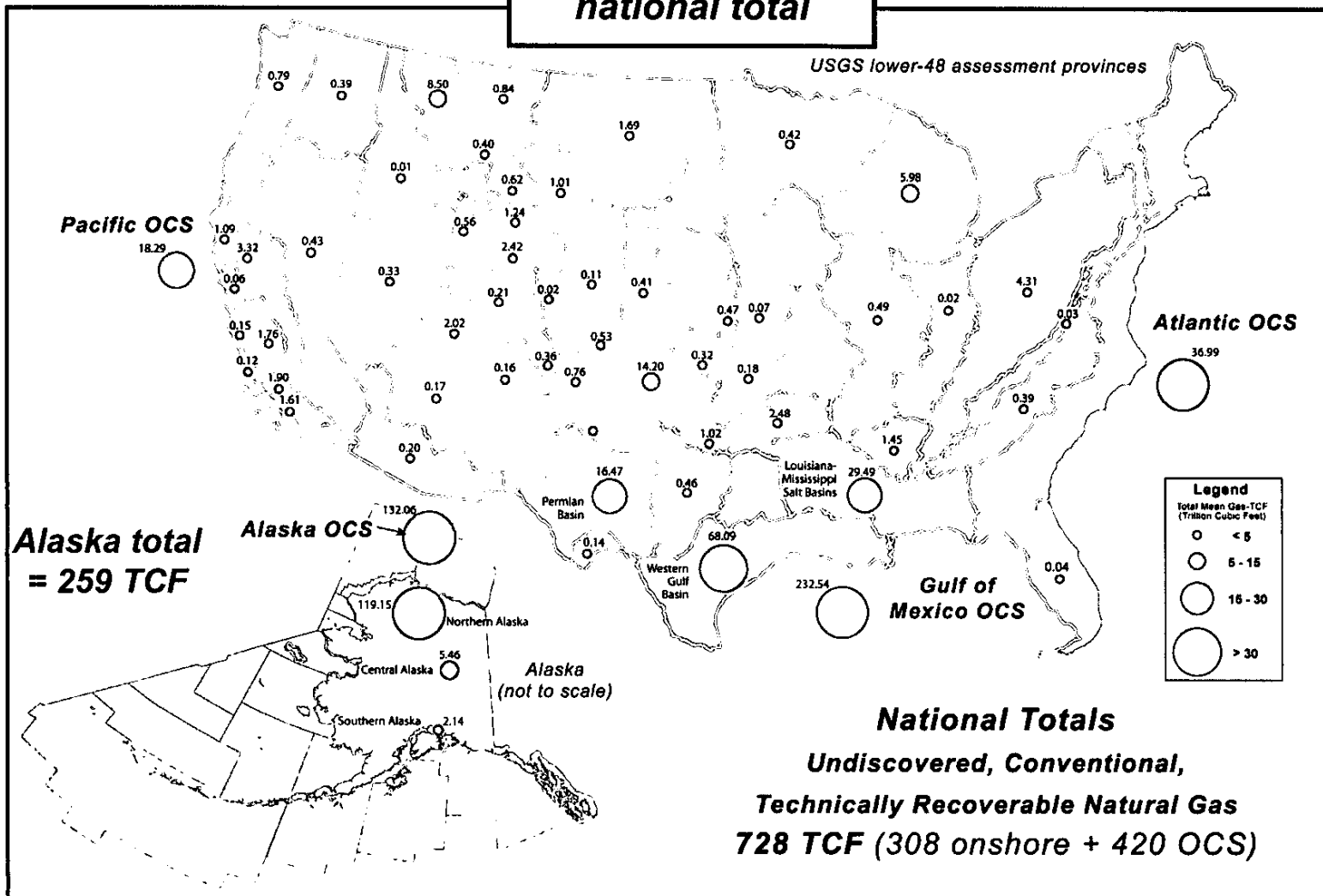
Source: USGS Fact Sheet 2008-3049

# Undiscovered, Conventional Gas Resources of the U.S.

**Alaska resources = 36% of national total**

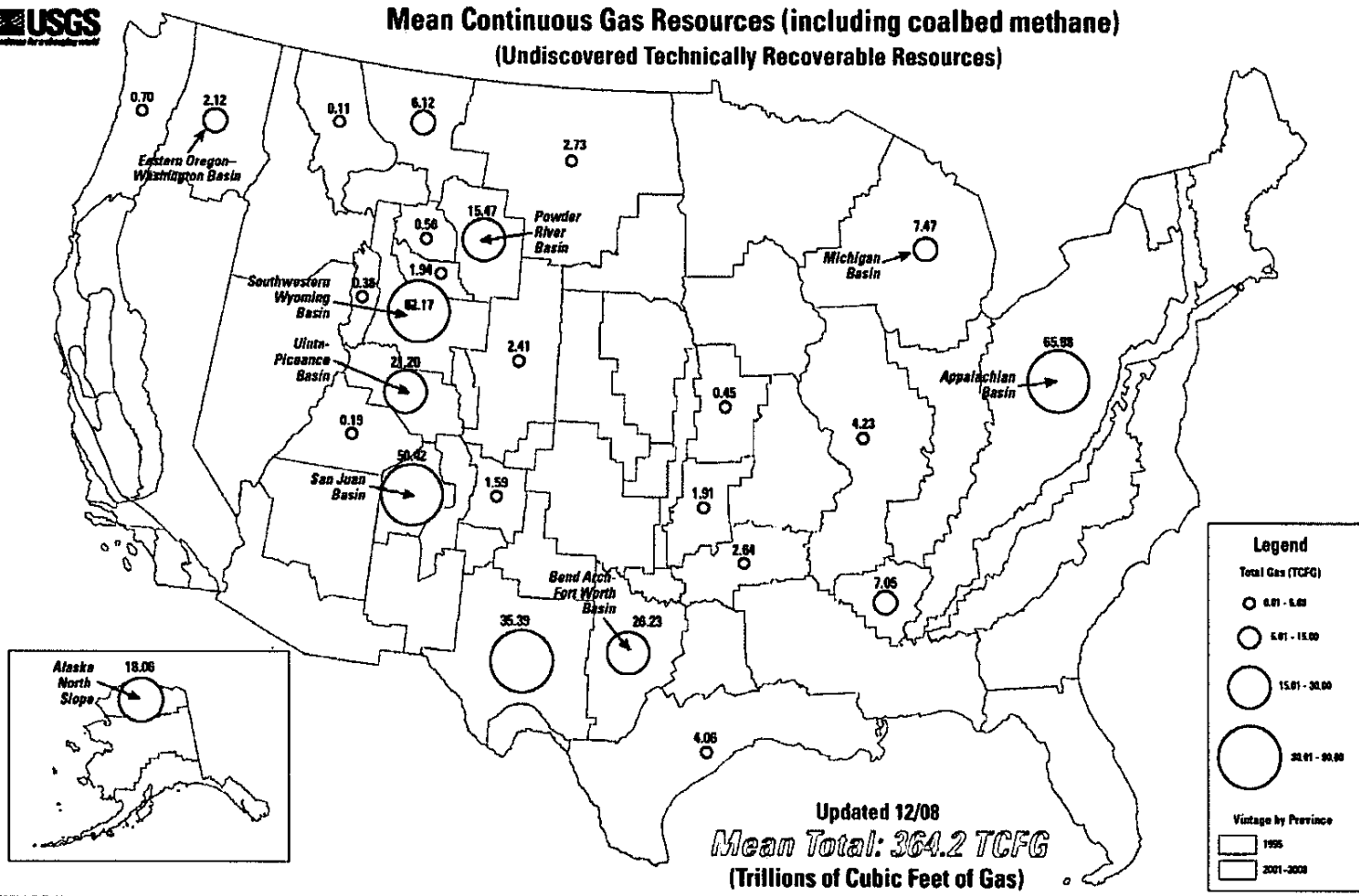
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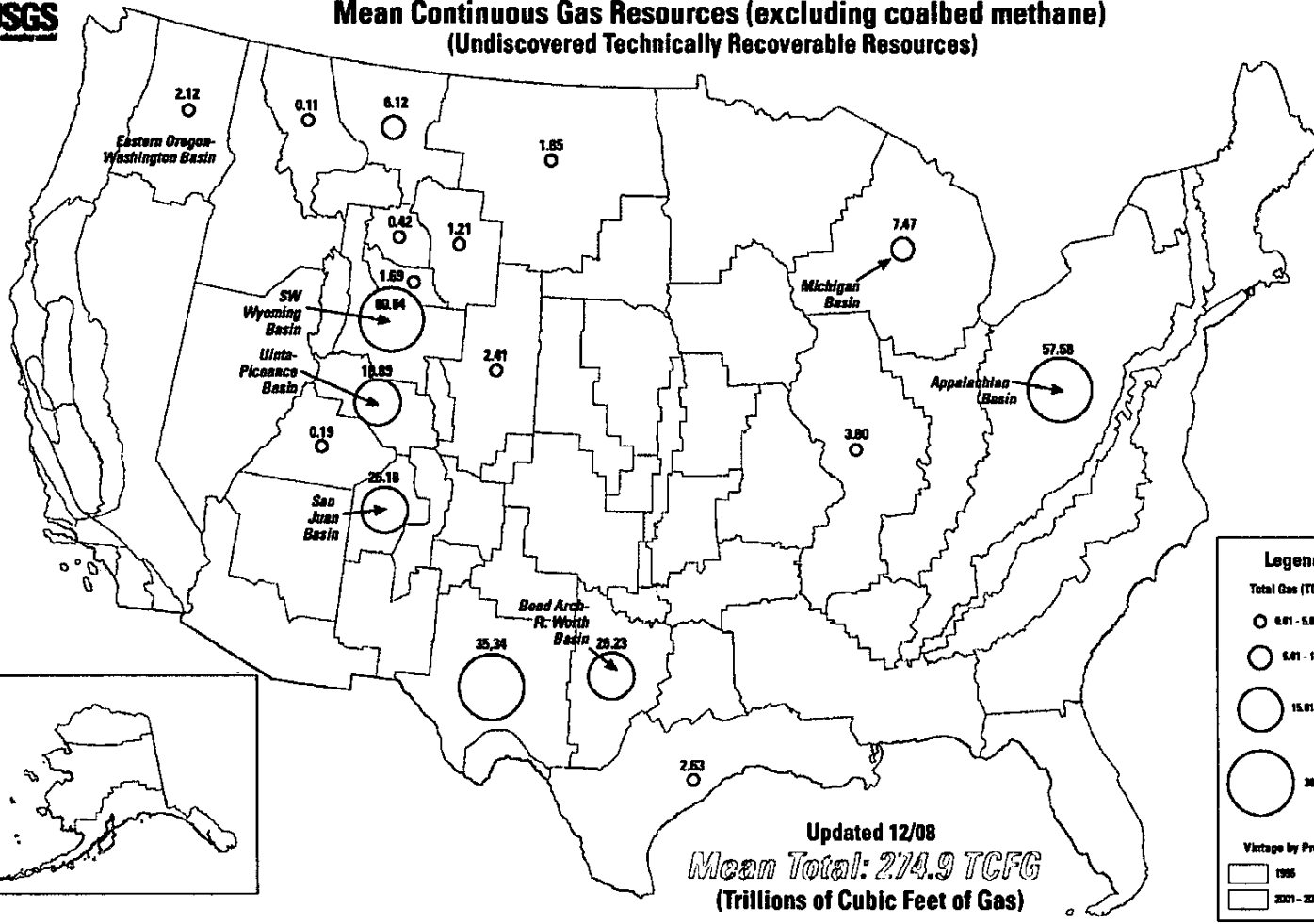


### Mean Continuous Gas Resources (including coalbed methane) (Undiscovered Technically Recoverable Resources)





### Mean Continuous Gas Resources (excluding coalbed methane) (Undiscovered Technically Recoverable Resources)



**Legend**

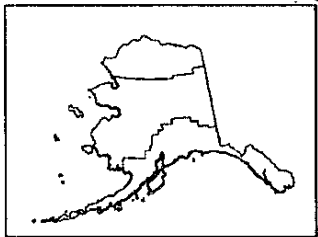
Total Gas (TCFG)

- 0.01 - 5.00
- 5.01 - 15.00
- 15.01 - 30.00
- 30.01 - 90.00

Vintage by Province

- 1995
- 2001 - 2008

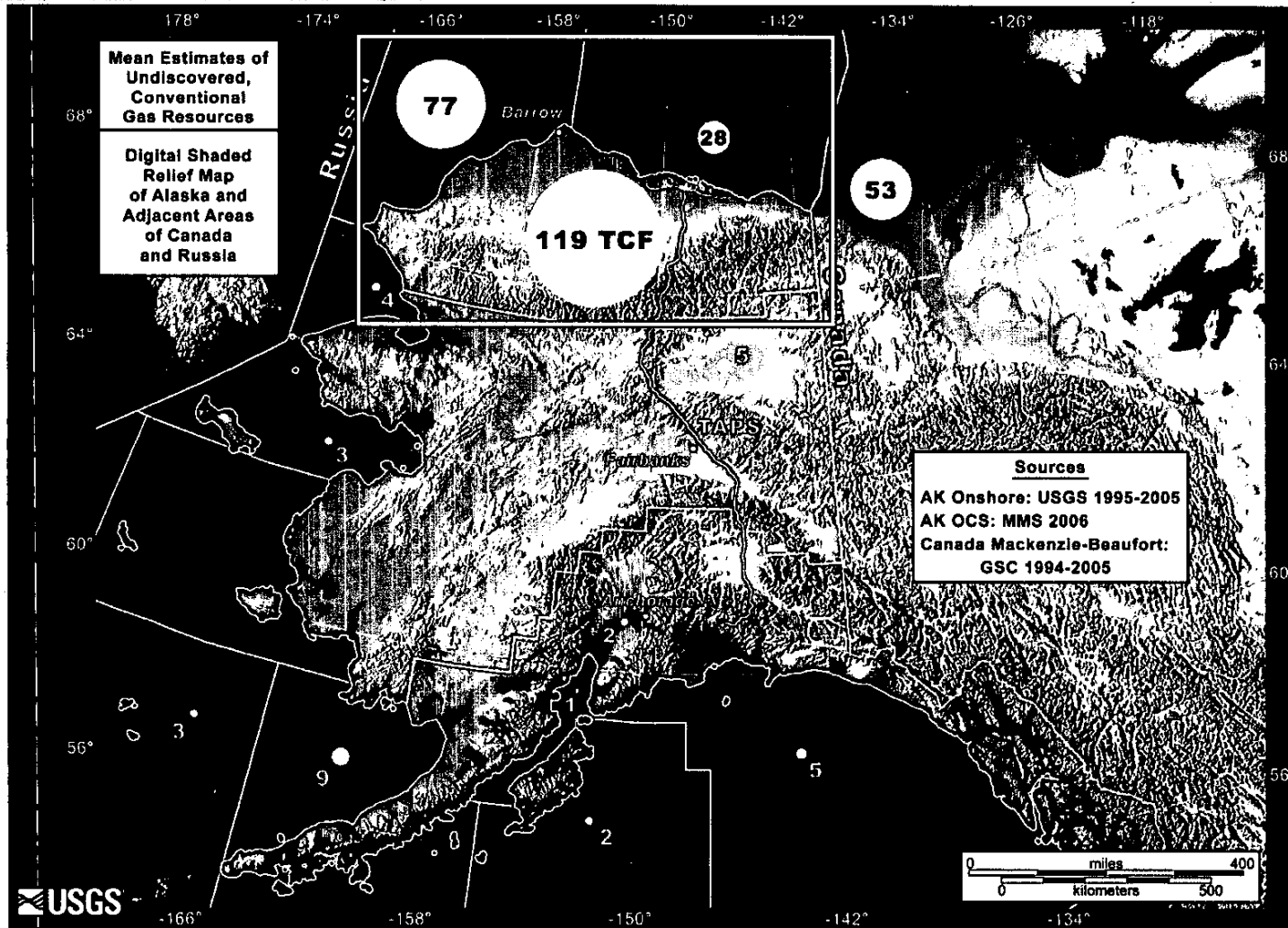
Updated 12/08  
**Mean Total: 274.9 TCFG**  
 (Trillions of Cubic Feet of Gas)



# Undiscovered Conventional Gas Potential

# AGIA

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# Potential for Undiscovered Petroleum in Arctic Alaska

USGS/MMS

AGIA

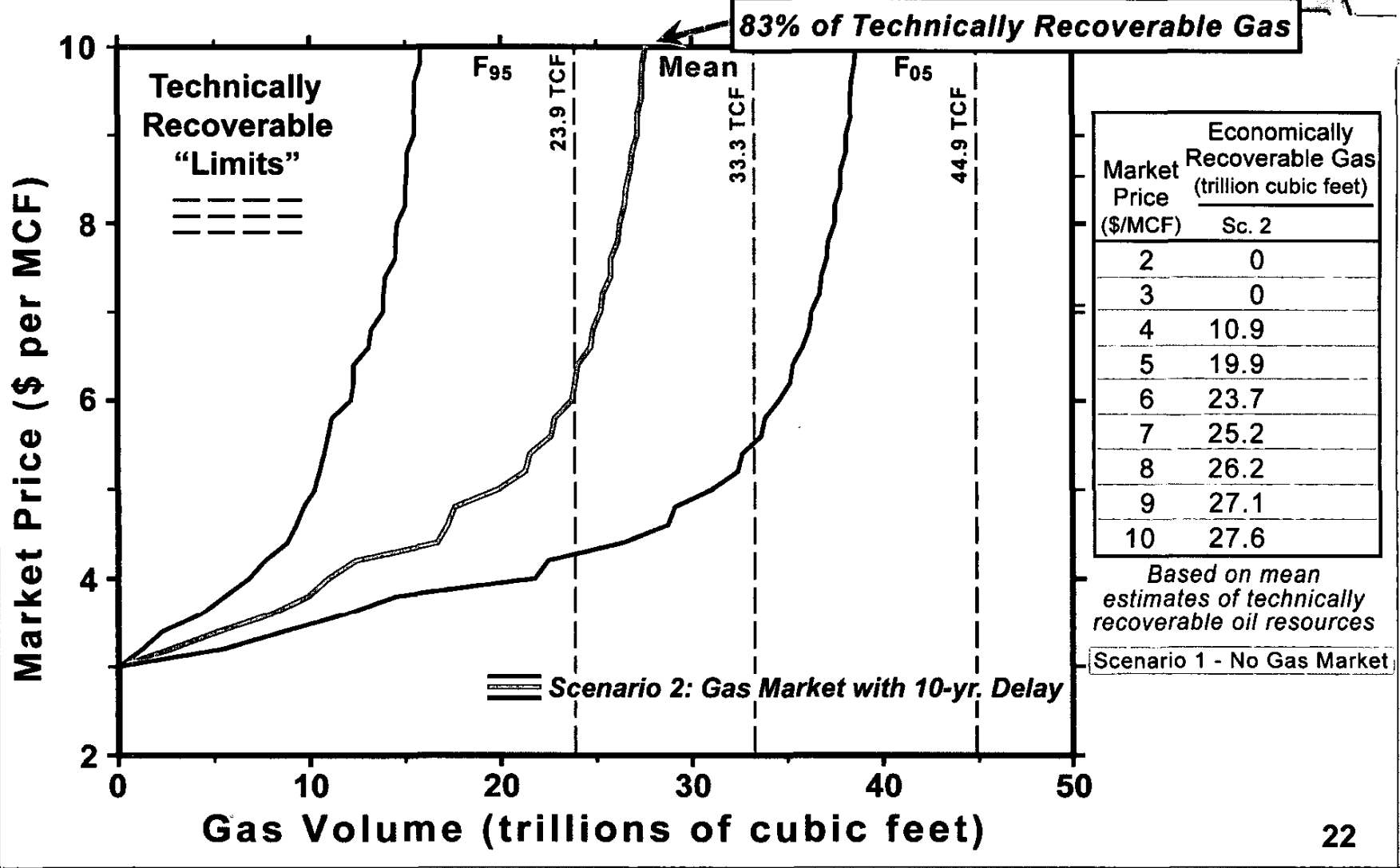
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## Mean Estimates of Undiscovered, Conventional Natural Gas in Arctic Alaska (trillion cubic feet)

	Non- Associated Gas	Associated Gas	Total Gas
<i>Onshore &amp; State Offshore Areas (USGS estimates)</i>			
<b>NPRA</b>	<b>61.35</b>	<b>11.68</b>	<b>73.03</b>
<b>Central North Slope</b>	<b>33.32</b>	<b>4.20</b>	<b>37.52</b>
<b>ANWR, 1002 Area</b>	<b>3.84</b>	<b>4.76</b>	<b>8.60</b>
<b>Subtotal</b>	<b>98.51</b>	<b>20.64</b>	<b>119.15</b>
<i>Federal Offshore Areas (MMS estimates)</i>			
<b>Chukchi Shelf</b>	<b>na</b>	<b>na</b>	<b>76.77</b>
<b>Beaufort Shelf</b>	<b>na</b>	<b>na</b>	<b>27.65</b>
<b>Hope Basin</b>	<b>na</b>	<b>na</b>	<b>3.77</b>
<b>Subtotal</b>	<b>na</b>	<b>na</b>	<b>108.19</b>
<b>TOTAL</b>			<b>227.34</b>

# Central North Slope Economically Recoverable Gas

USGS



# North Slope Gas Potential

DOE

# AGIA

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Location	Estimate of undiscovered technically recoverable conventional natural gas	Estimate of economically recoverable* natural gas reserves
	(Trillion Cubic Feet) Mean	(Trillion Cubic Feet) Mean
National Petroleum Reserve, Alaska	73.0	31.0
Central North Slope, State Lands	37.5	33.3
ANWR 1002 area	8.6	1.0
<b>TOTAL Onshore Potential</b>	<b>119 TCF</b>	<b>66.3 TCF</b>
Chukchi Sea	76.8	50.0
Beaufort Sea	27.7	21.0
Hope Basin ?	3.8	
<b>TOTAL Offshore Potential</b>	<b>108 TCF</b>	<b>71.0 TCF</b>
<b>TOTAL TCF</b>	<b>227 TCF</b>	<b>137.3</b>

Data Sources: Regional Resource Assessments from the U.S. Geological Survey, <http://energy.usgs.gov/alaska/> and Minerals Management Service <http://www.mms.gov/alaska/re/reports/2006Asmt/>

\*NETL This study did not include Hope Basin.

# Alaska's North Slope is Very Under-Explored

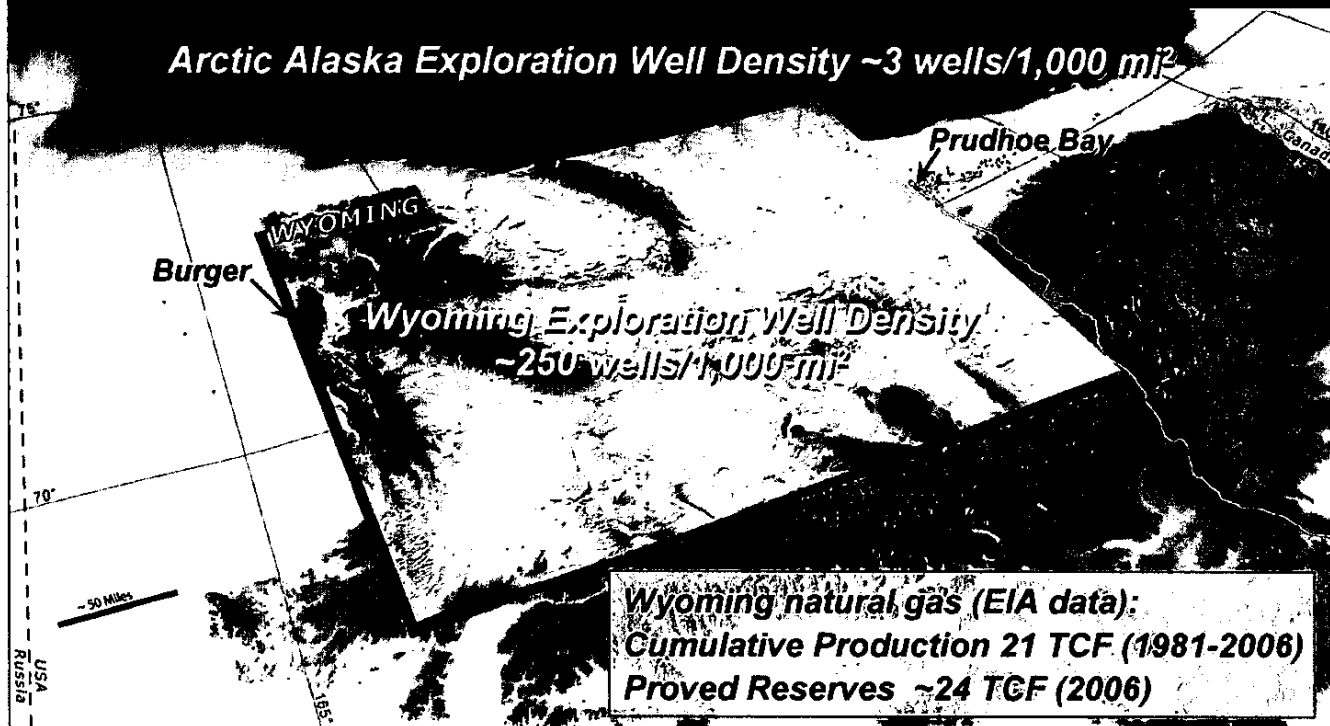
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## Arctic Alaska Exploration Maturity

- Prospective area onshore & offshore shelves ~ 150,000 mi<sup>2</sup> (~400,000 km<sup>2</sup>)
- Fewer than 500 exploration wells (red dots)

Arctic Alaska Exploration Well Density ~3 wells/1,000 mi<sup>2</sup>



- Entire state of Wyoming ~100,000 mi<sup>2</sup> (~250,000 km<sup>2</sup>)
- Petroleum-prospective area ~75,000 mi<sup>2</sup> (~250,000 km<sup>2</sup>)
- ~19,371 exploration wells

14

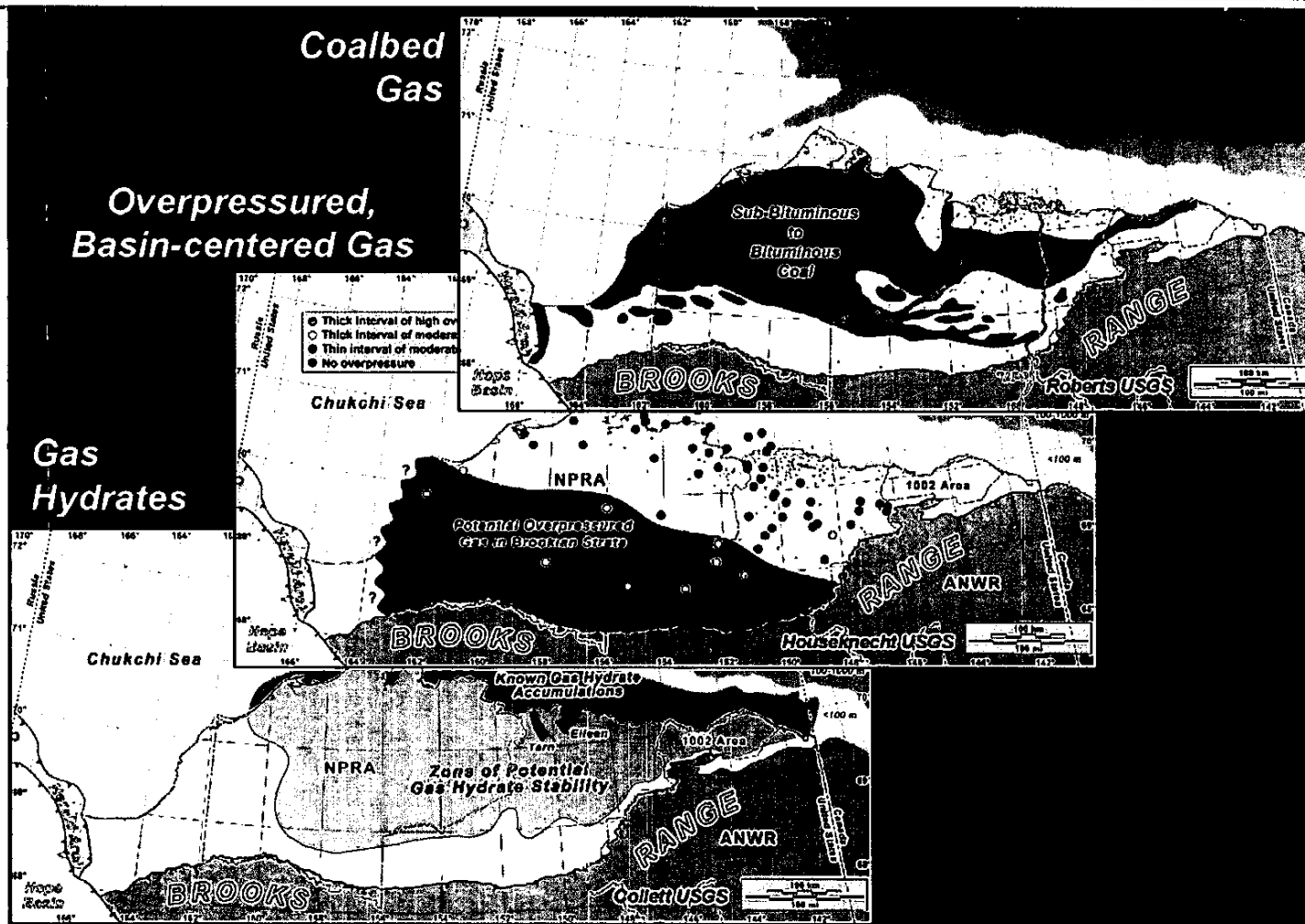
24

Courtesy of USGS

# Unconventional Gas Resources (continuous resources)

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# Alaska North Slope Natural Gas Hydrate Assessment Results

# AGIA

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[BCFG, billion cubic feet of gas. MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. Fractiles are additive, assuming perfect positive correlations. NGL, natural gas liquids; TPS, total petroleum system; AU, assessment unit.]

Total Petroleum System and Assessment Unit	Field Type	Total Undiscovered Resources							
		Gas (BCFG)				NGL (MMBNGL)			
		F95	F50	F5	Mean	F95	F50	F5	Mean
<b>Northern Alaska Gas Hydrate TPS</b>									
Sagavanirktok Formation Gas Hydrate AU	<i>Gas</i>	6,285	19,490	37,791	20,567	0	0	0	0
Tuluvak-Schrader Bluff-Prince Creek Formations Gas Hydrate AU	<i>Gas</i>	8,173	26,532	51,814	28,003	0	0	0	0
Nanushuk Formation Gas Hydrate AU	<i>Gas</i>	10,775	35,008	68,226	36,857	0	0	0	0
<b>Total Undiscovered Resources</b>		<b>25,233</b>	<b>81,030</b>	<b>157,831</b>	<b>85,427</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

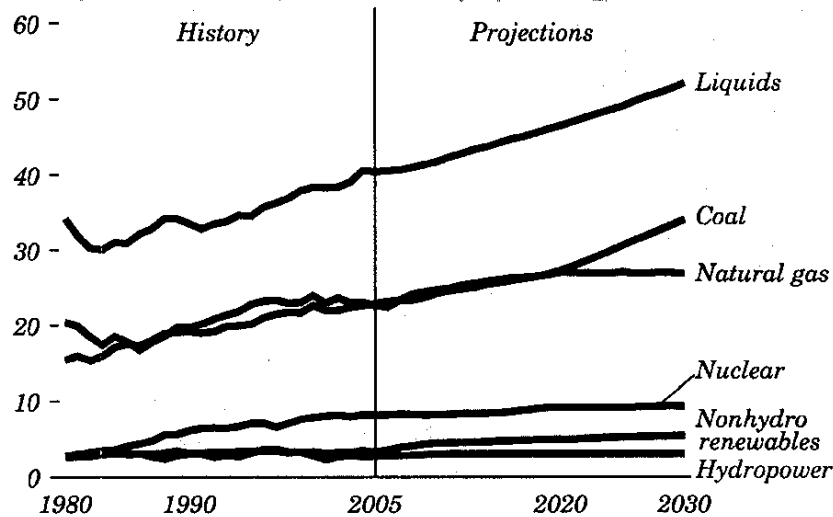
Source: USGS Fact Sheet 2008-3073

# Alaska's Arctic Natural Gas: Critical Bridge to a Sustainable Future

# AGIA

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## United States Energy Consumption by Fuel



EIA

USGS

## Carbon Emissions

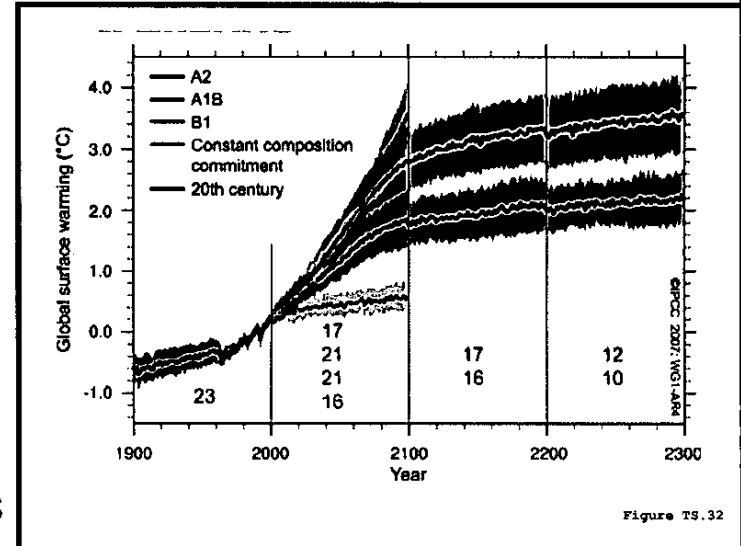
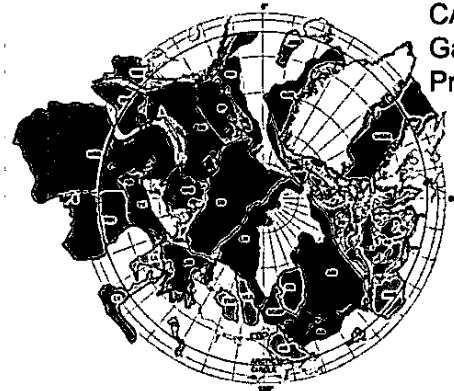


Figure TS.32

CARA  
Gas  
Provinces

IPCC 2007: WG1-AR4



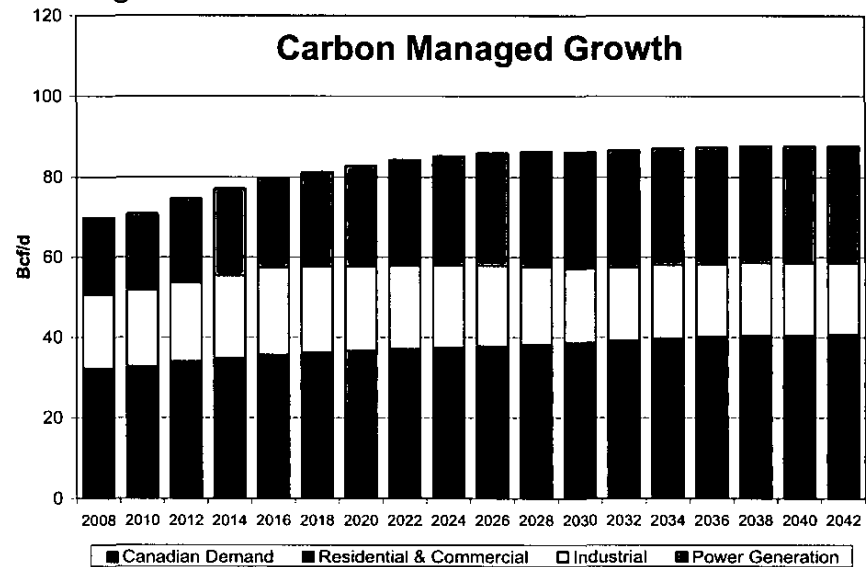
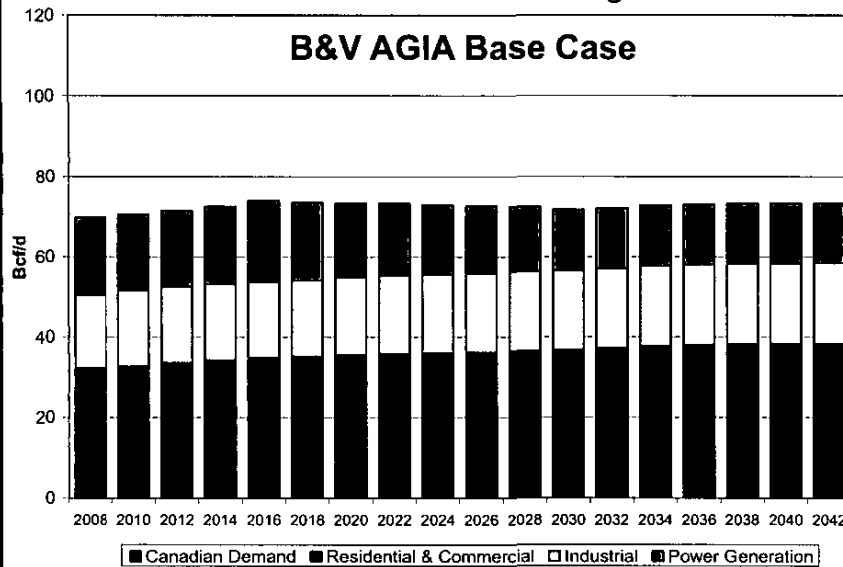
# Impact of Carbon Regulation on Natural Gas Demand



The Alaska Gasline Inducement Act

## In a Carbon Managed Growth case, demand is 14 Bcf/d more than the B&V AGIA Base Case

- Policies and legislations designed to curb Green House Gas could reduce dispatch and construction of coal-fired generation facilities in favor of natural gas fired facilities, resulting in demand increase from the power sector in the US
- All resources, including renewables, nuclear and IGCC with CCS and gas fired combined cycles are all needed to meet electric demand growth. Gas demand from the power sector will grow from 19 Bcf/d in 2008 to 29 Bcf/d by 2030, with a CAGR of 2%
- Total demand in US lower 48 states is 12.1 Bcf/d higher than BV's AGIA Base Case by 2042. Canada demand is 2.3 Bcf/d higher in the Carbon Managed Growth case



Source: Black & Veatch Analysis

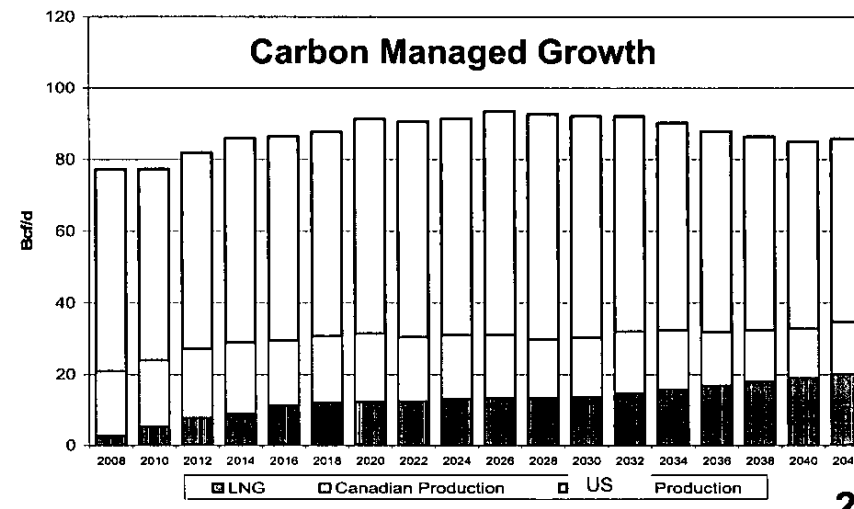
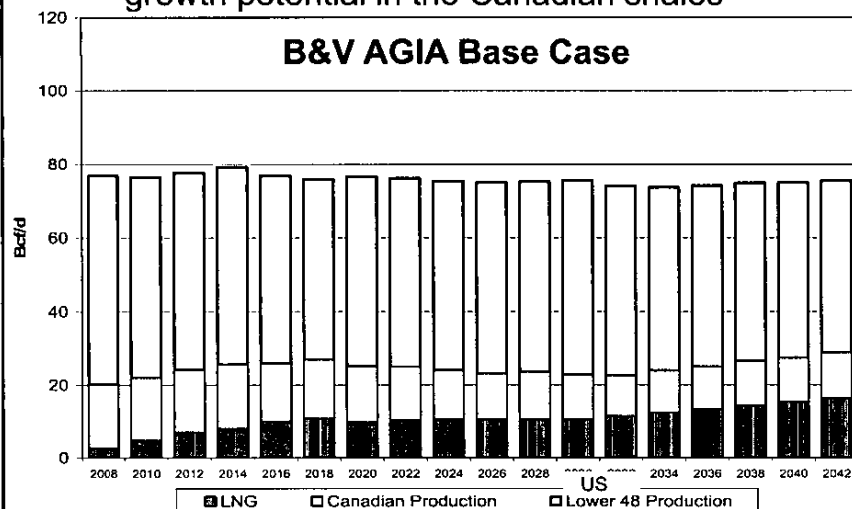
## Multiple Different Sources of Natural Gas will be Needed to Meet Lower 48 Demand Growth

# AGIA

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Additional LNG imports and more unconventional productions from the US is necessary in order to meet the lower 48 demand growth

- Additional LNG imports will be needed to meet the demand growth; 6.4 Bcf/d by 2042 in the Carbon Managed Growth scenario
- US Production will average 58.3 Bcf/d from 2022-2042 in the Carbon Managed Growth case, which will be 7.8 Bcf/d higher than the B&V AGIA Base Case. Recent developments in shale discoveries in Haynesville and Marcellus indicate greater production potentials from these unconventional resources. The production growth can be considered as a proxy.
- Canadian production continues to decline in both cases. In the Carbon Managed Growth case, Canadian production is 3.7 Bcf/d higher than in the B&V AGIA Base Case, which may approximately reflect the growth potential in the Canadian shales



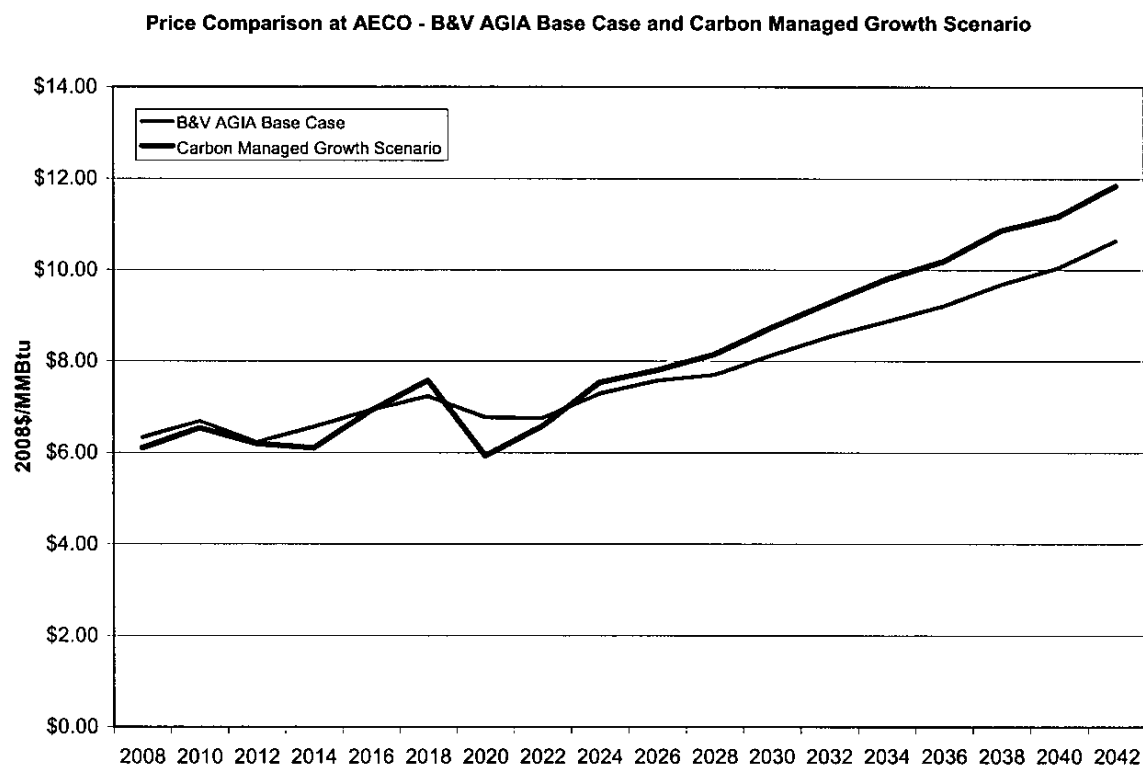
Source: Black & Veatch Analysis

# Impact of Carbon Regulation on AECO Price Forecasts

# AGIA

The Alaska Gasline Inducement Act

- The Carbon Managed Growth case has sufficient supplies from North America to meet the high demand from both unconventional production and slightly higher additional LNG volumes
- North American gas price is projected to have a higher price path than in the AGIA base case



# Liquid Natural Gas (LNG) Imports Current and Forecast Volumes

# AGIA

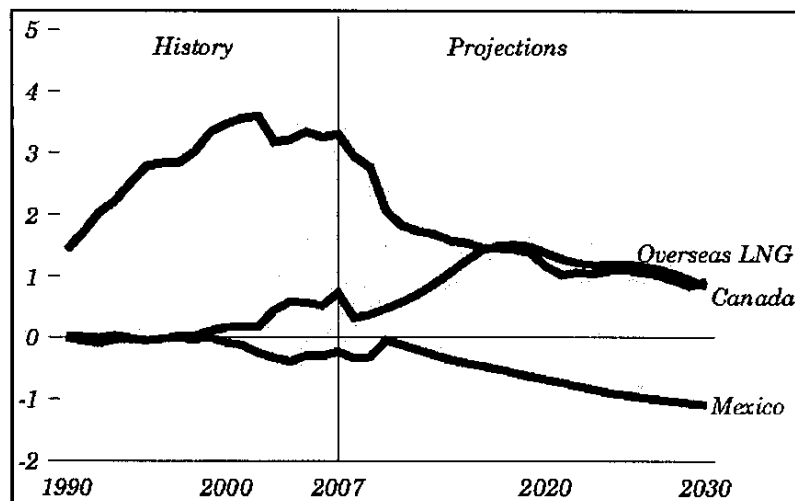
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LNG import volumes have experienced little net change since the legislature approved the AGIA license

## Total US LNG Import Volumes

July 2008: 31,019 mmcf

December 2008: 30,708 mmcf



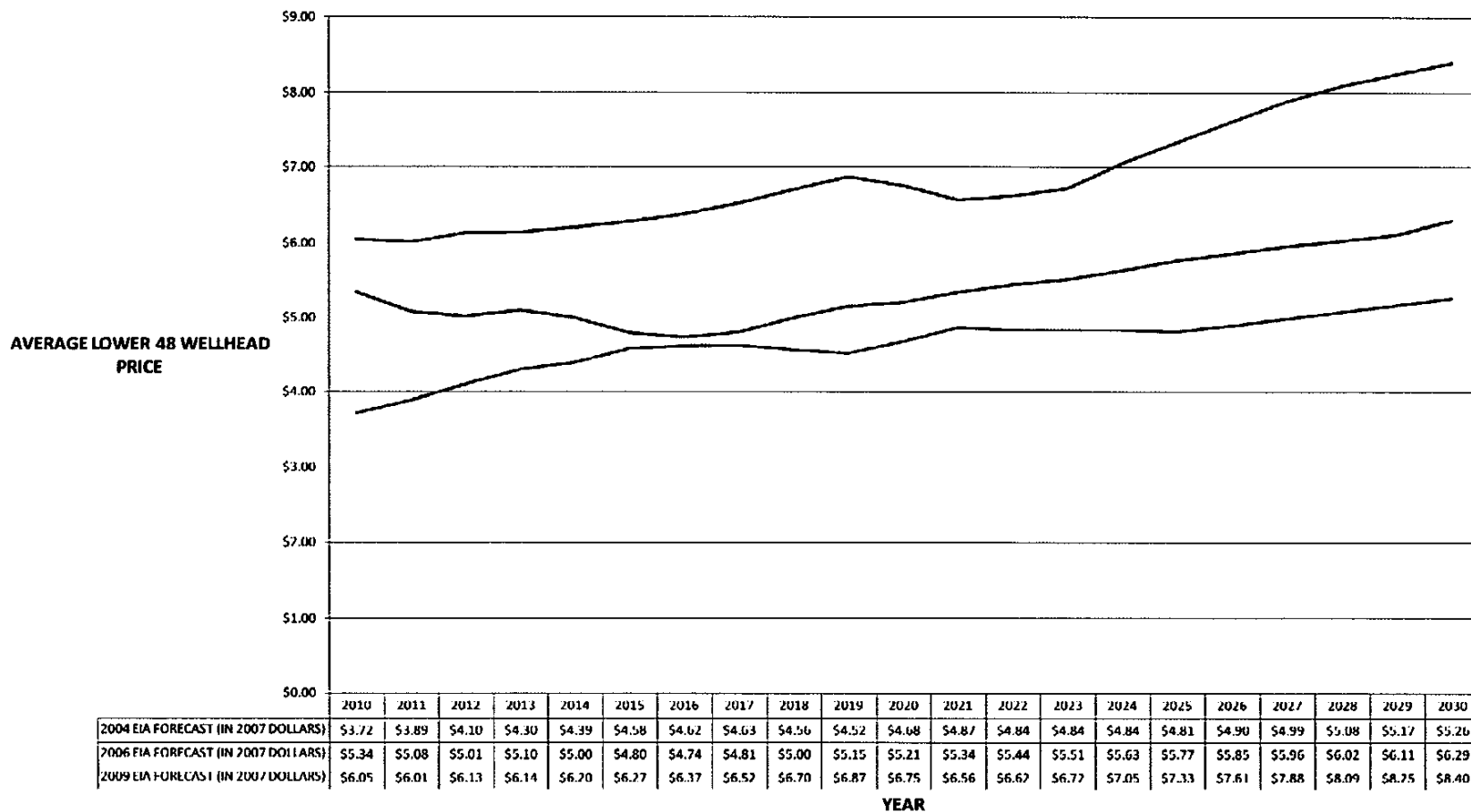
Net U.S. imports of natural gas by source,  
1990-2030 (trillion cubic feet)

# More Recent EIA Price Forecasts for Gas Predict Higher Long-term Prices for Natural Gas in the U.S.



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EIA FORECASTED NATURAL GAS PRICES



— 2004 EIA FORECAST (IN 2007 DOLLARS)      — 2006 EIA FORECAST (IN 2007 DOLLARS)      — 2009 EIA FORECAST (IN 2007 DOLLARS)

Atigun Gorge North Slope Alaska – Along the Gasline Route

Photo taken by David Houseknecht USGS

# AGIA

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# Historic AECO Basis to Henry Hub (Monthly Averages)



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