



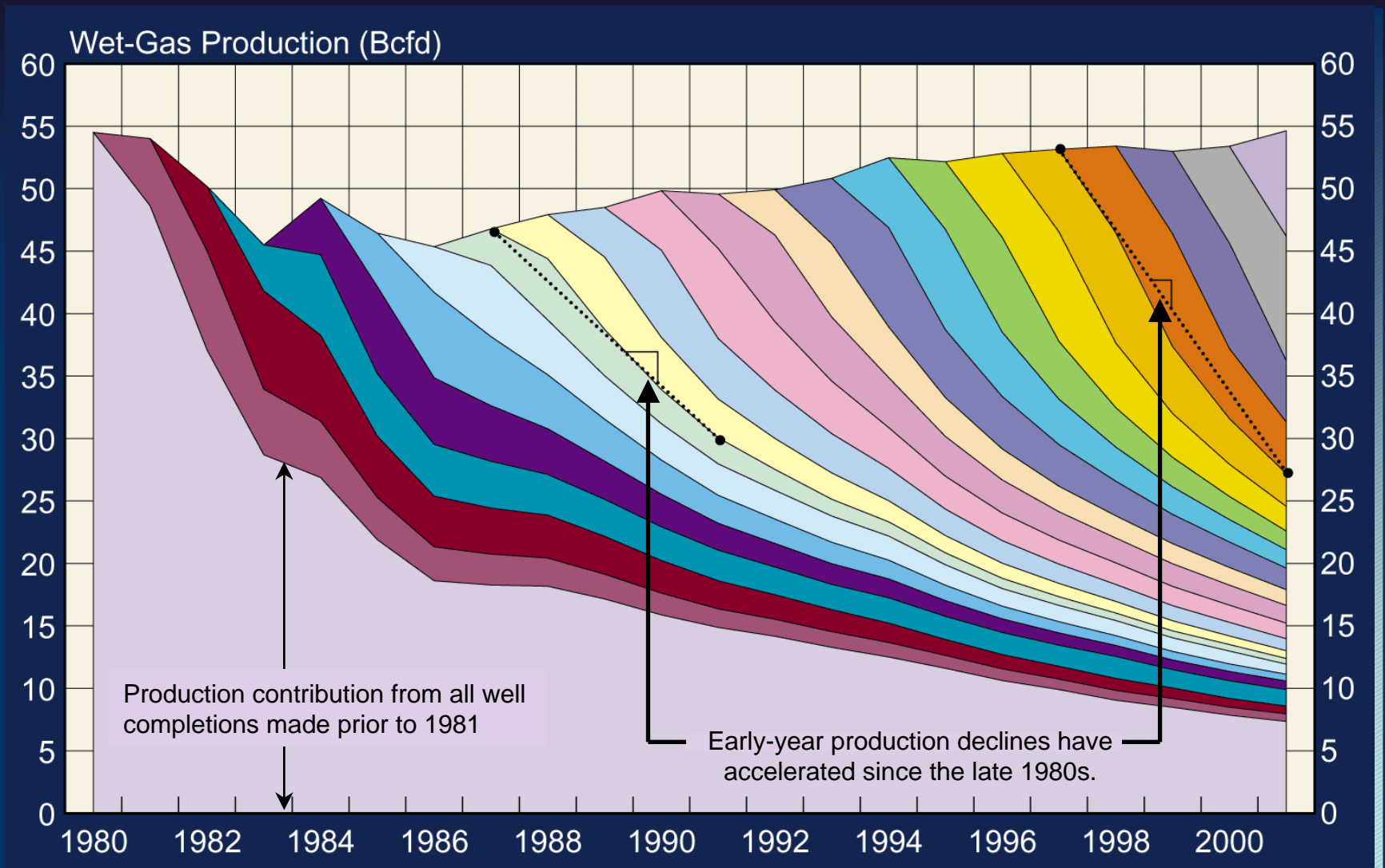
North American  
Natural Gas  
Resources:  
Yesterday, Today  
and  
Tomorrow

**John B. Curtis**

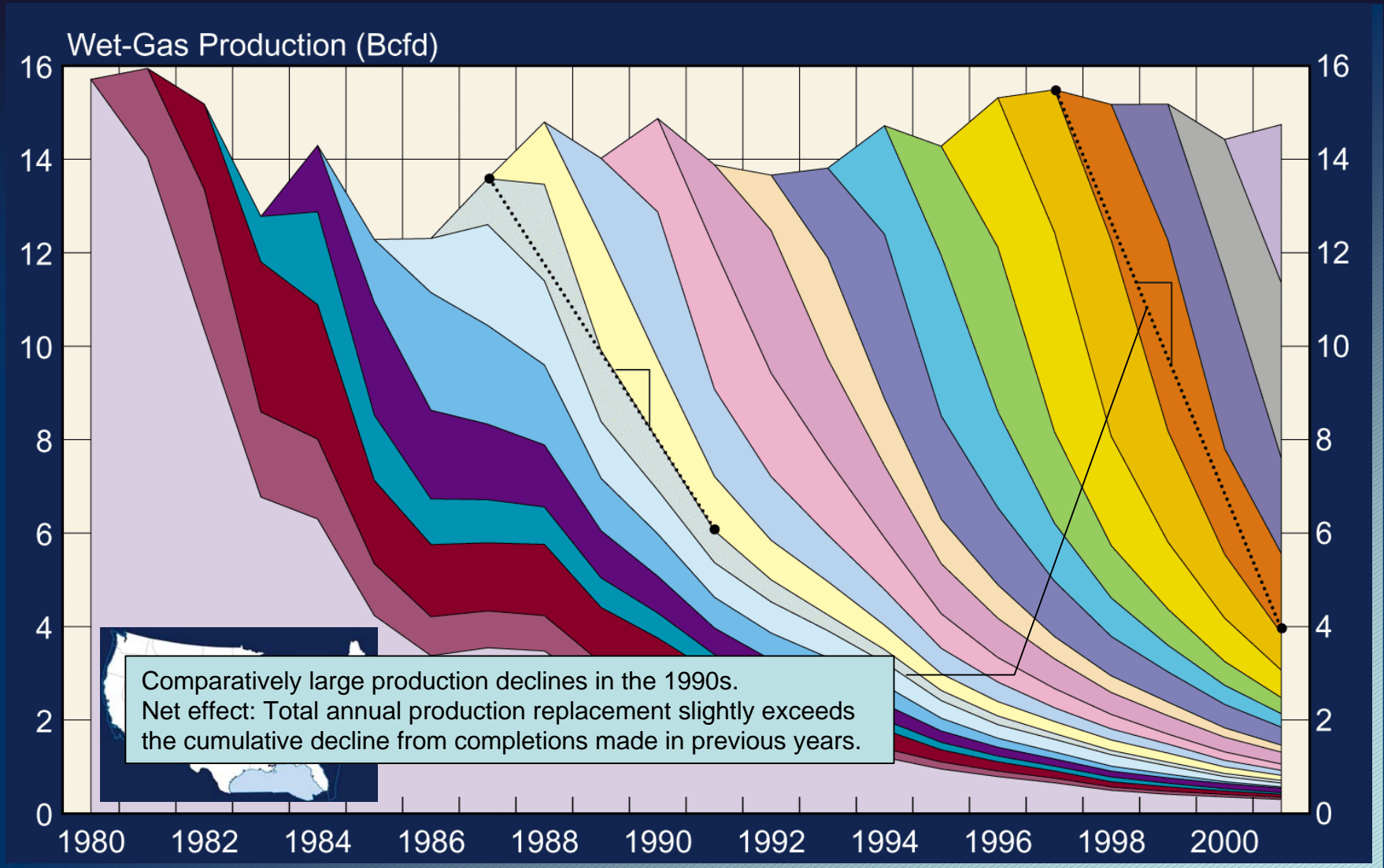
**Potential Gas Agency  
Colorado School of Mines**

Presented to  
NEMS/AEO  
Conference  
March 23, 2004

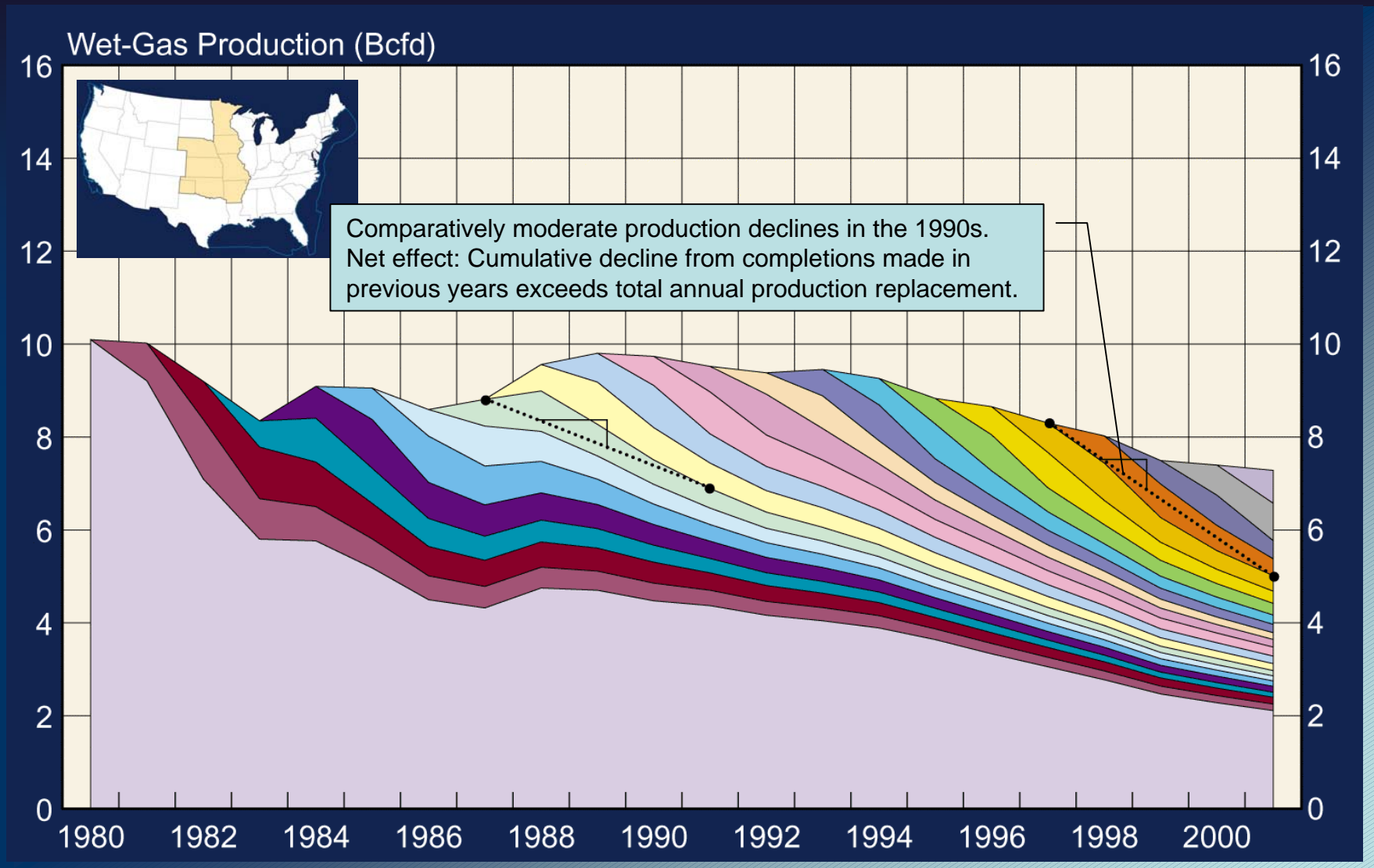
# Gas Production Replacement, L48 US



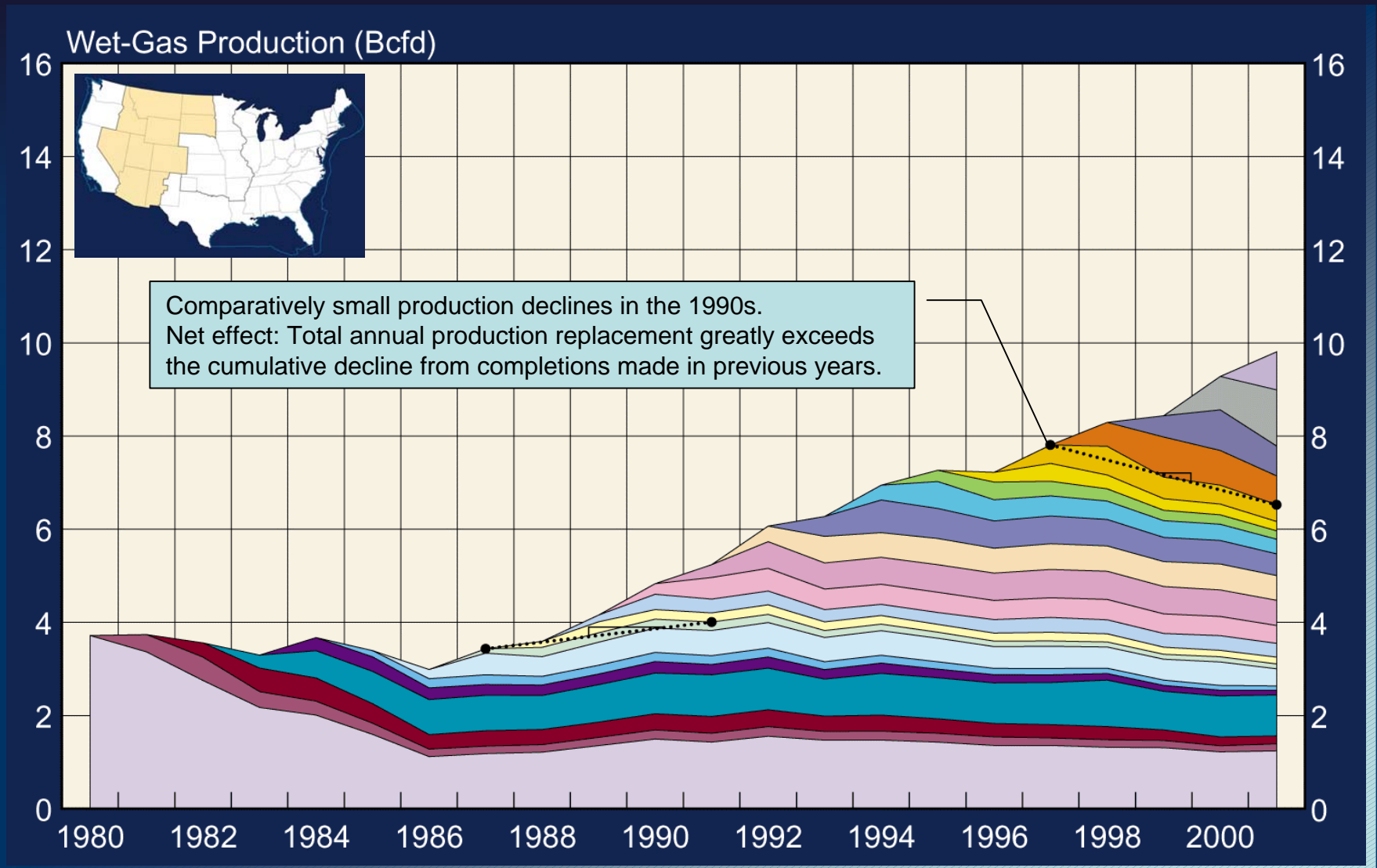
# Gas Production Replacement, Gulf of Mexico



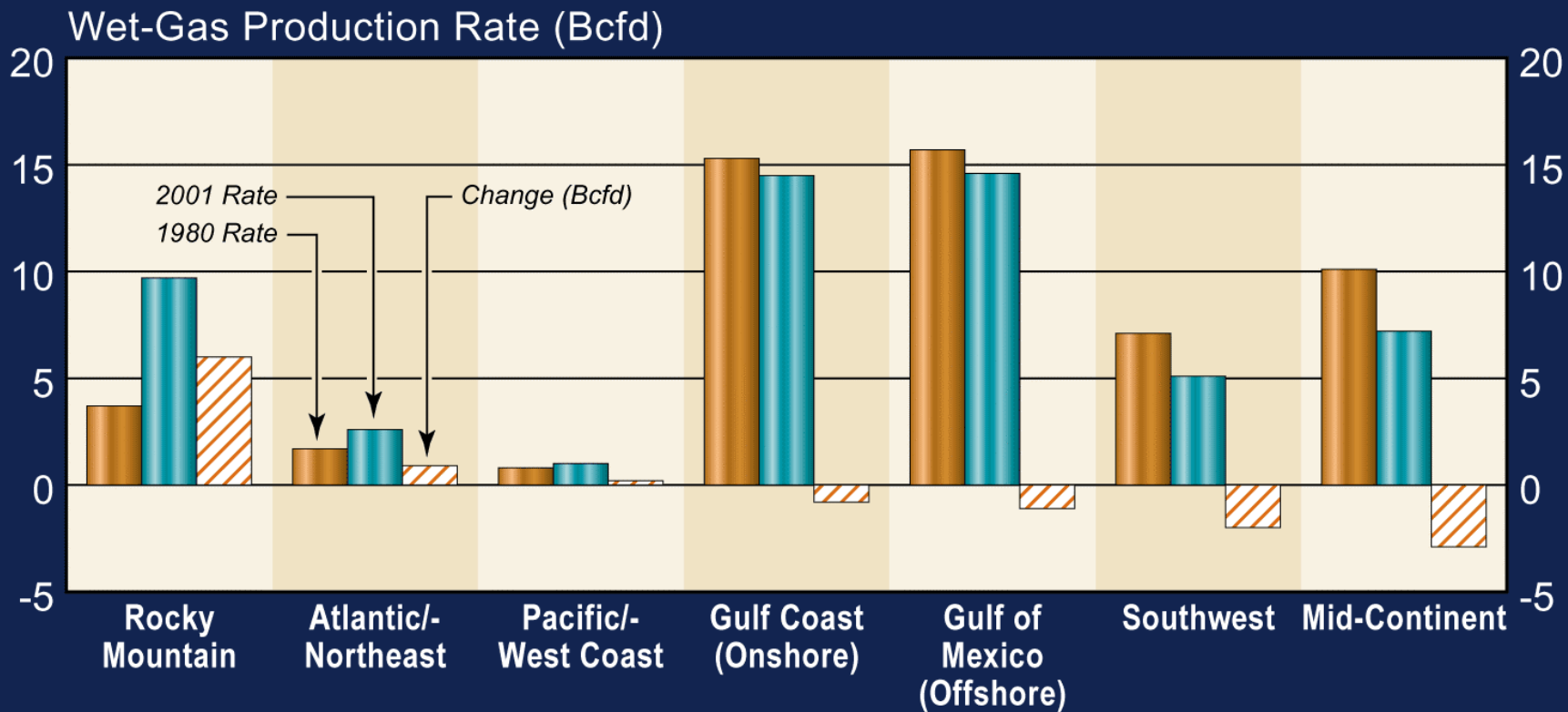
# Gas Production Replacement, Mid-Continent



# Gas Production Replacement, Rocky Mtns.



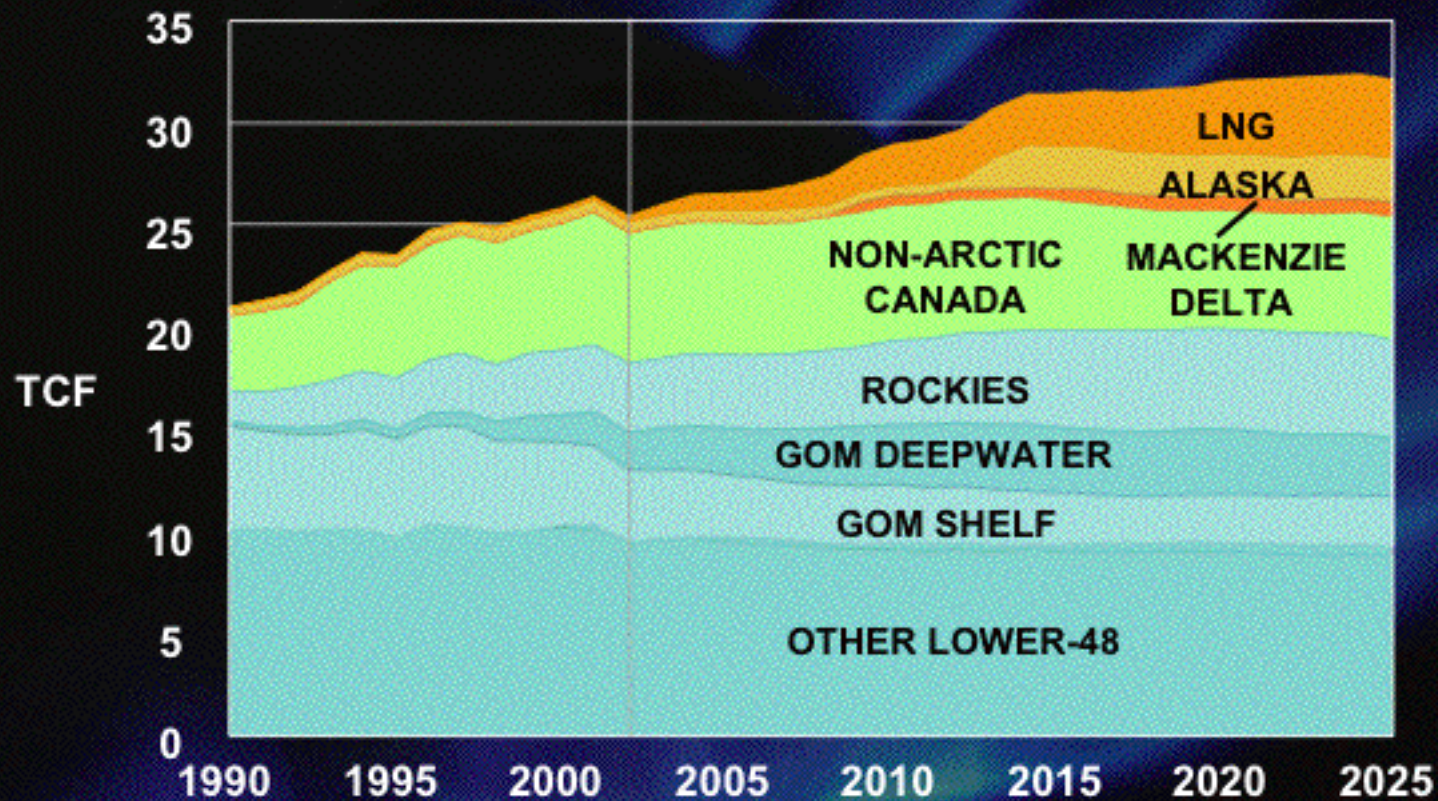
# Regional Production Rate Comparison



# Regional Production Rate Summary

EIA Region	Production Rate, 1980 (Bcfd)	Production Rate, 2001 (Bcfd)	Change (Bcfd)	Change (%)
Rocky Mountain	3.7	9.7	+6.0	+162.2%
Atlantic/ Northeast	1.7	2.6	+0.9	+52.9%
Pacific/West Coast	0.8	1.0	+0.2	+25.0%
Gulf Coast	15.3	14.5	-0.8	-5.2%
Gulf of Mexico	15.7	14.6	-1.1	-7.0%
Southwest	7.1	5.1	-2.0	-28.2%
Mid-Continent	10.1	7.2	-2.9	-28.7%
<b>Total Lower 48</b>	<b>54.5</b>	<b>54.7</b>	<b>+0.3</b>	<b>+0.6%</b>

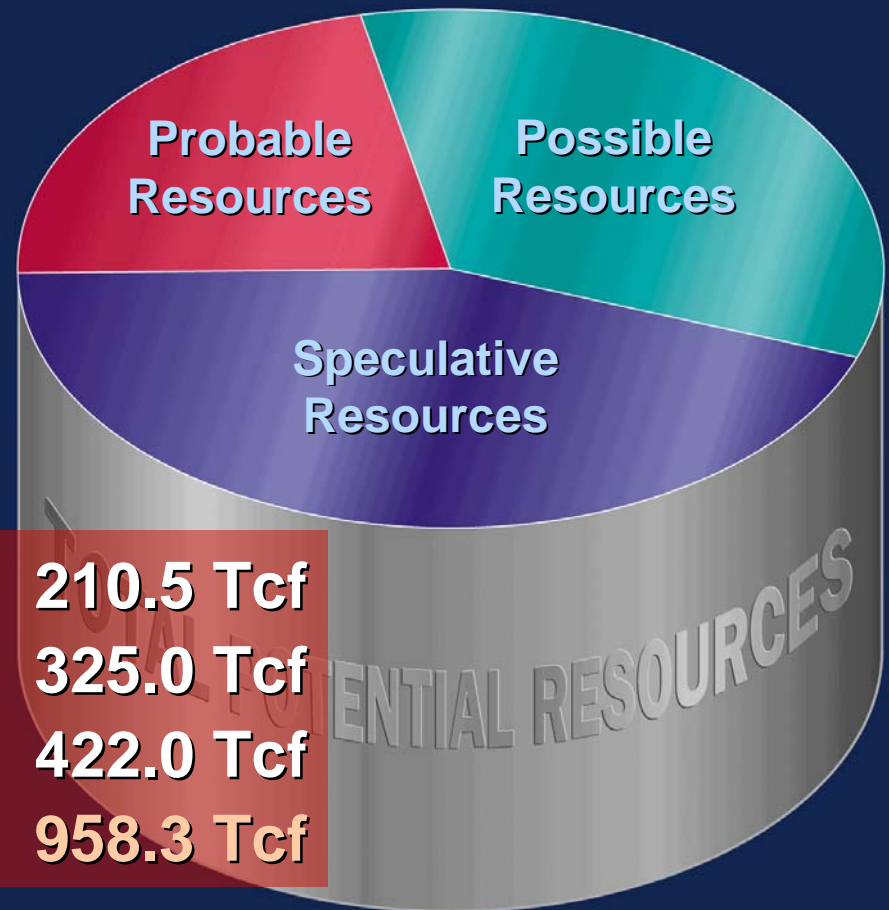
# Future Supplies Come from Traditional and New Sources





# PGC Resource Assessment 2002

Total Potential Resources (mean values) by category

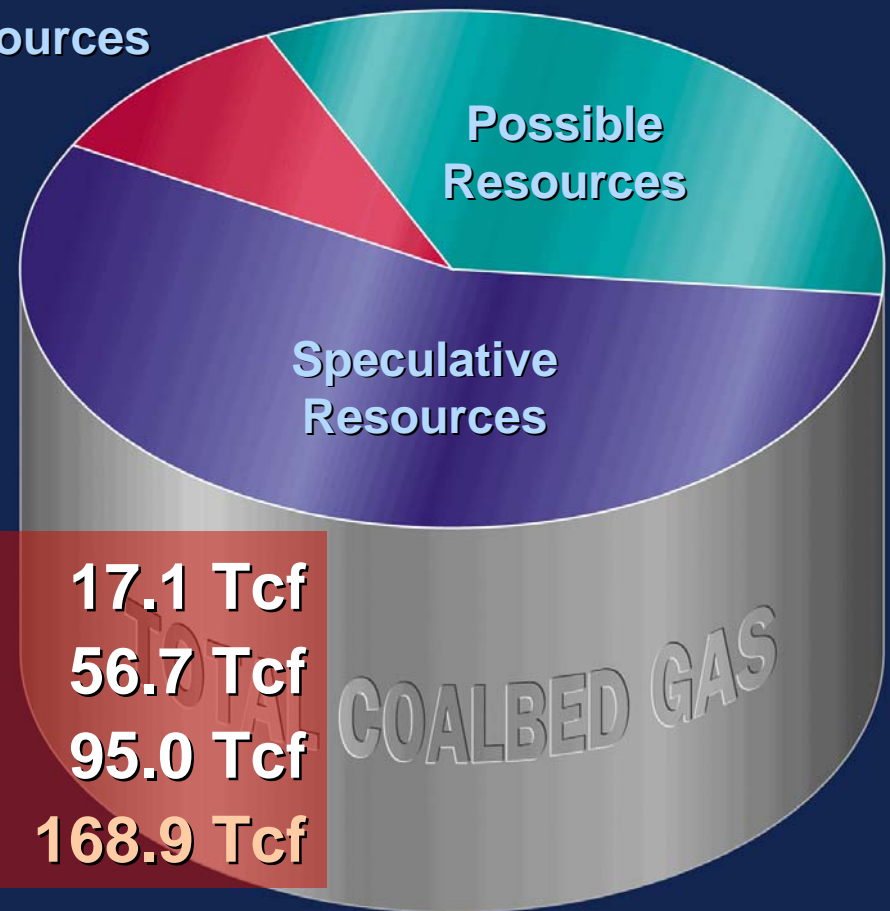


<b>Probable (existing fields)</b>	<b>210.5 Tcf</b>
<b>Possible (new fields)</b>	<b>325.0 Tcf</b>
<b>Speculative (frontier)</b>	<b>422.0 Tcf</b>
<b>Total</b>	<b>958.3 Tcf</b>

# PGC Resource Assessment 2002

Total Coalbed Gas Resources (mean values) by category

Probable  
Resources



**Probable (existing fields)**

**17.1 Tcf**

**Possible (new fields)**

**56.7 Tcf**

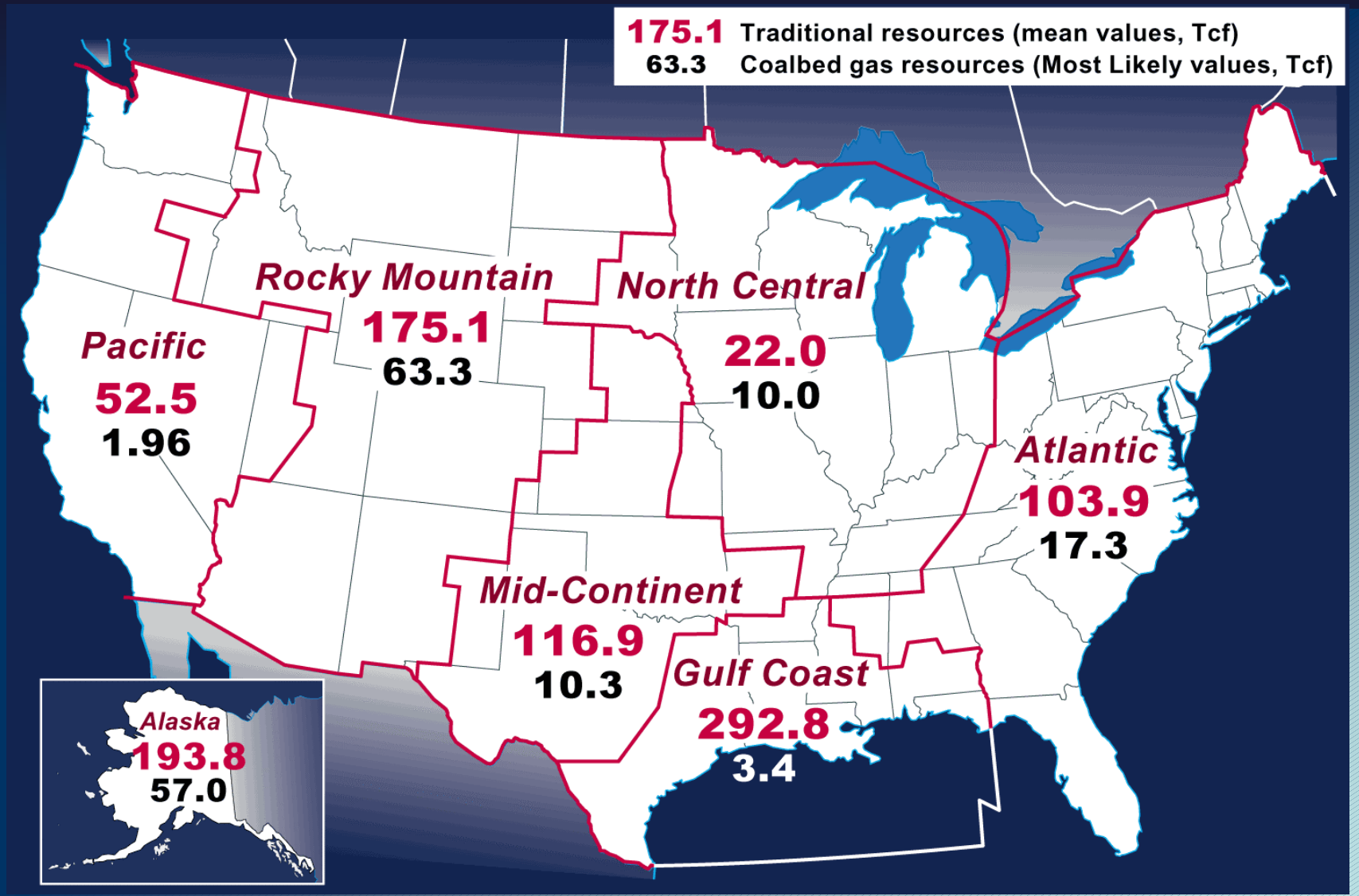
**Speculative (frontier)**

**95.0 Tcf**

**Total**

**168.9 Tcf**

# Regional Resource Assessment

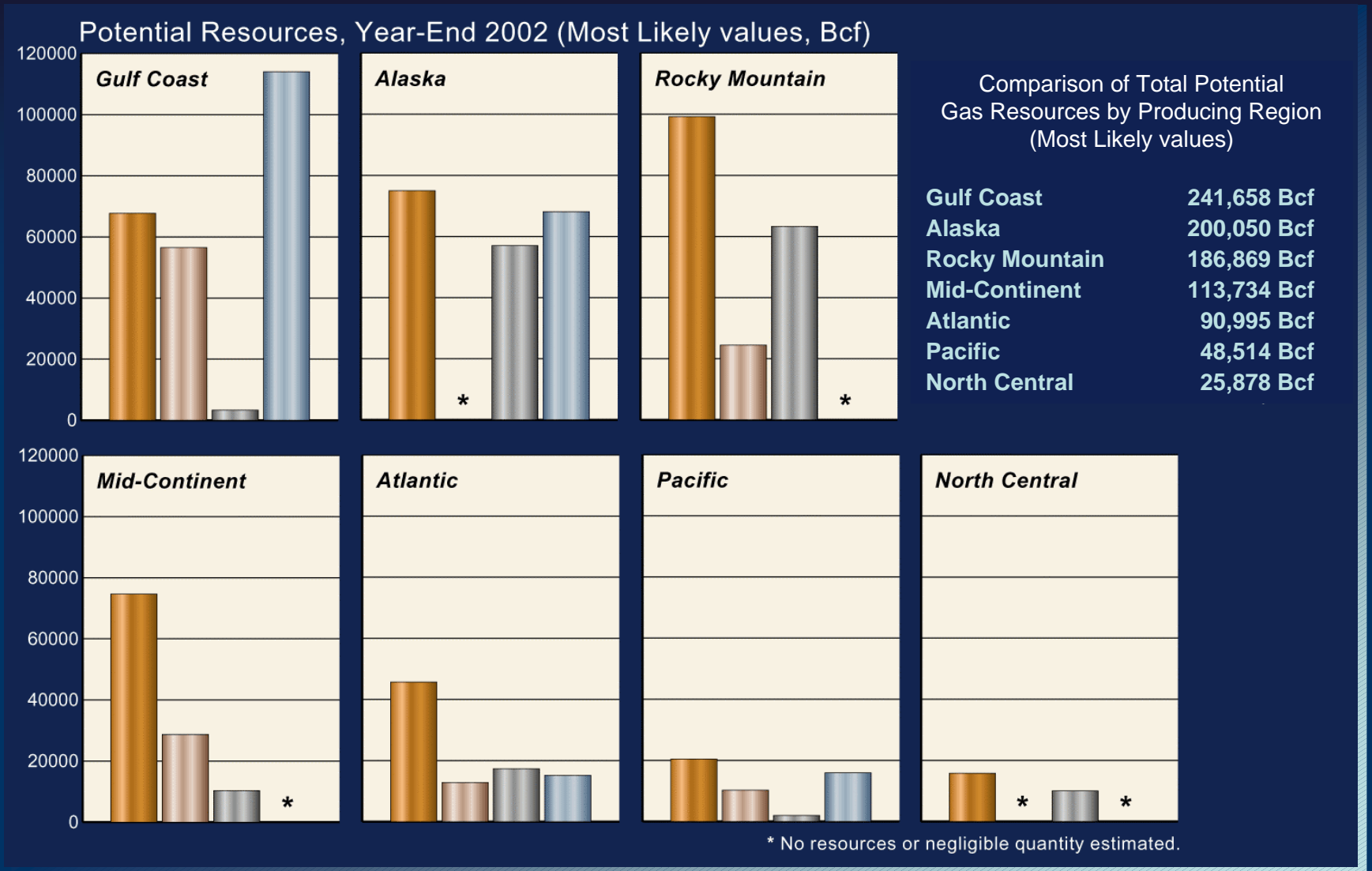


Data source: Potential Gas Committee (2003)

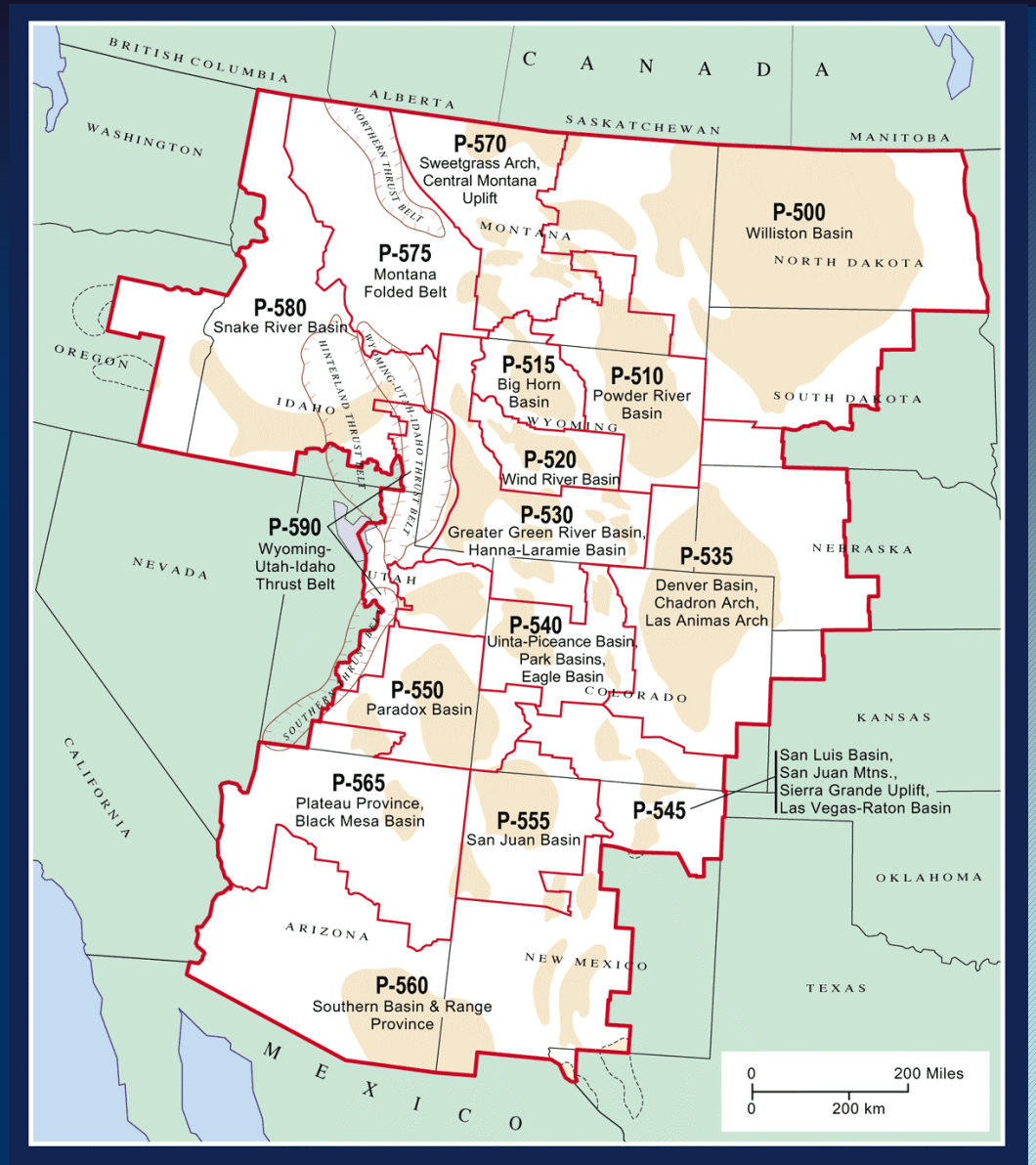
# Regional Resource Assessment Summary

PGC Area	Traditional Resources (Mean, Tcf)	Coalbed Gas Resources (M.L., Tcf)	Total Resources (Tcf)	Region's Proportion of Total L48
Gulf Coast	292.8	3.4	296.2	34.0%
Rocky Mountain	175.1	63.3	238.4	27.3%
Mid-Continent	116.9	10.3	127.2	14.6%
Atlantic	103.9	17.3	121.2	13.9%
Pacific	52.5	2.0	54.5	6.2%
North Central	22.0	10.0	32.1	3.7%
<b>Total Lower 48</b>	<b>765.6</b>	<b>106.3</b>	<b>871.9</b>	
Alaska	193.8	57.0	250.8	
<b>Total U.S. (means)</b>	<b>958.3</b>	<b>168.9</b>	<b>1,127.1</b>	

# Regional Resource Comparison

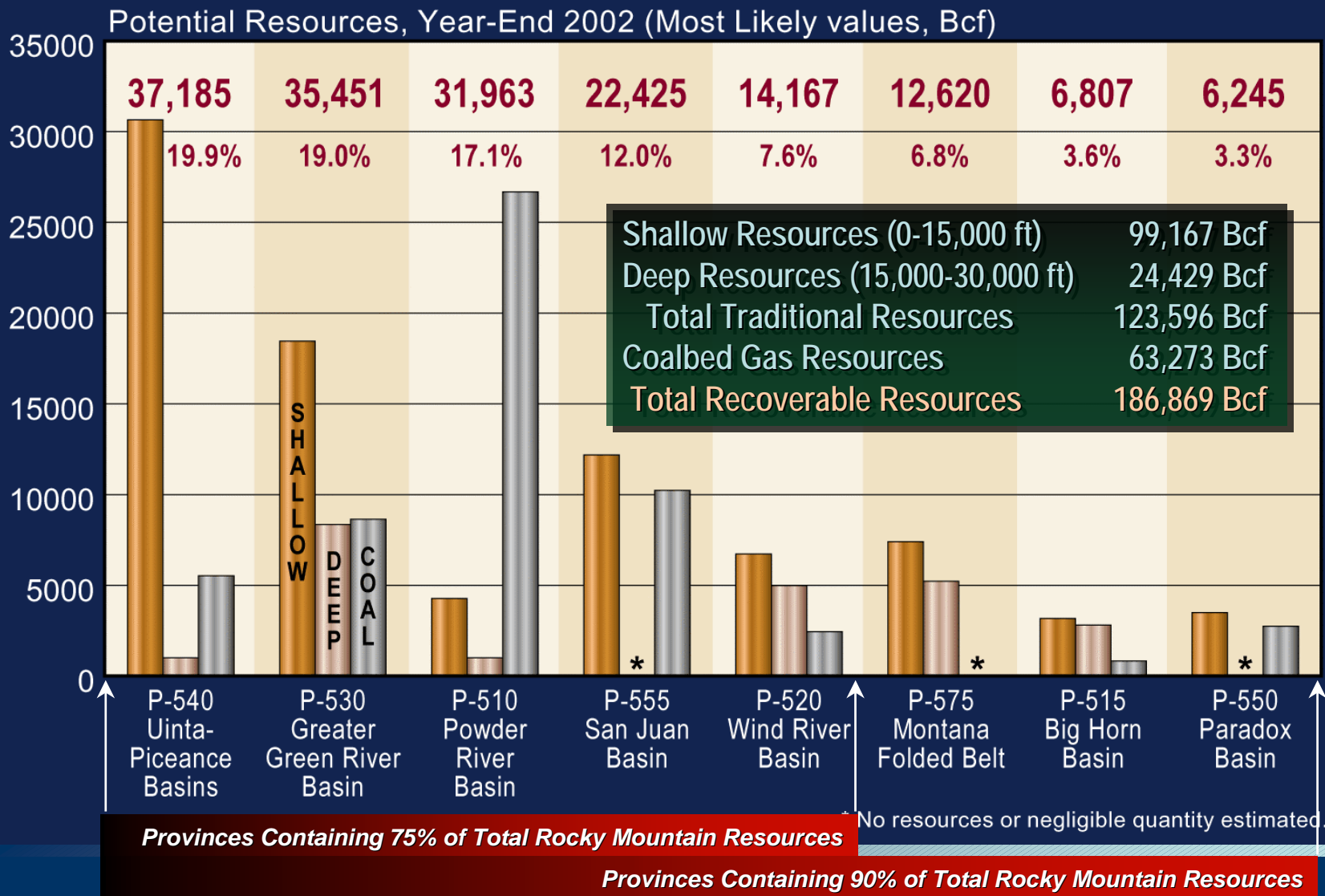


# Rocky Mountain Geologic Provinces

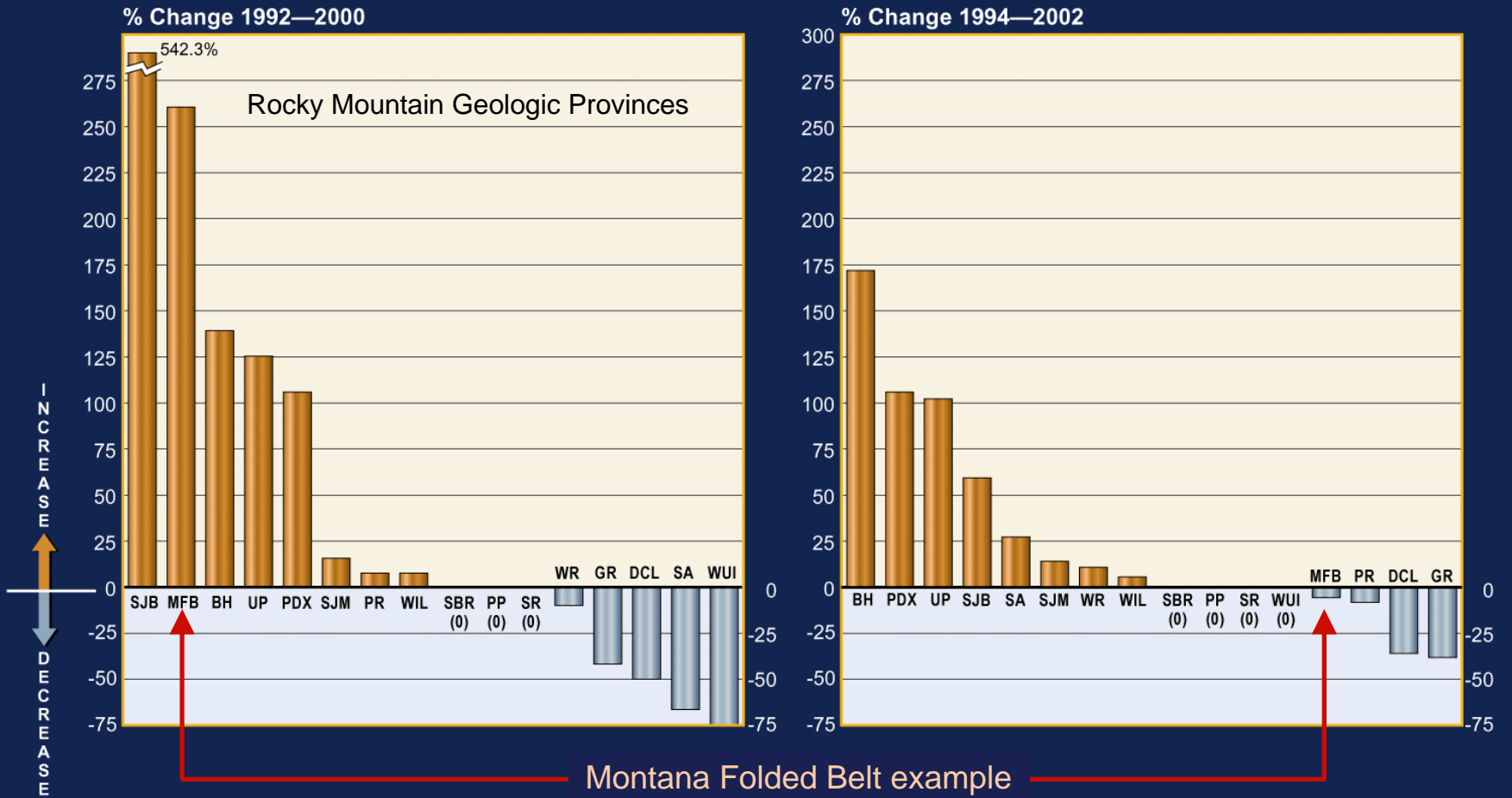


Source: Potential Gas Committee (2003)

# Rocky Mountain Resource Comparisons



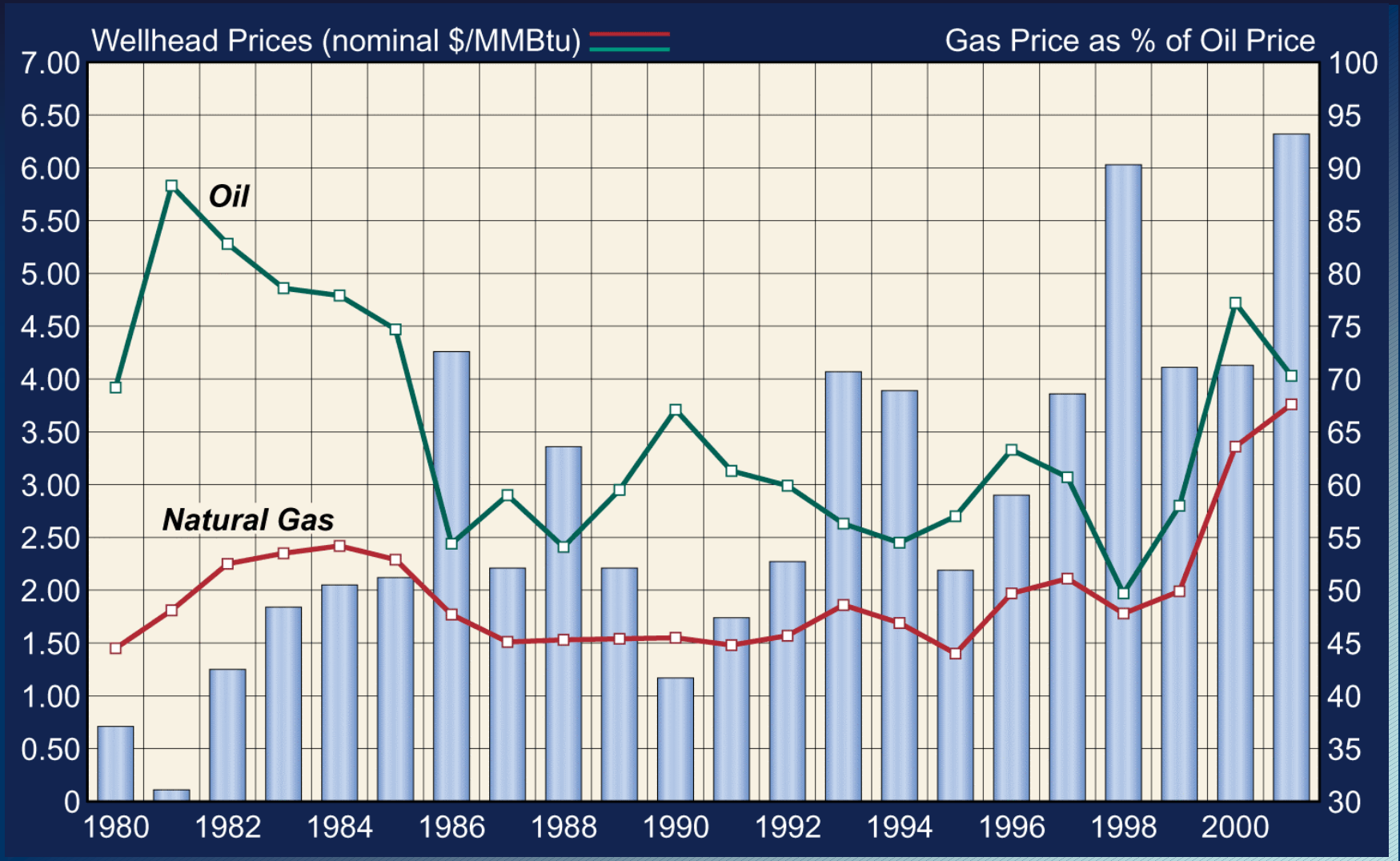
# Resource Assessments Change with Time



Potential Resources = Probable + Possible + Speculative  
(Most Likely values, all depths)

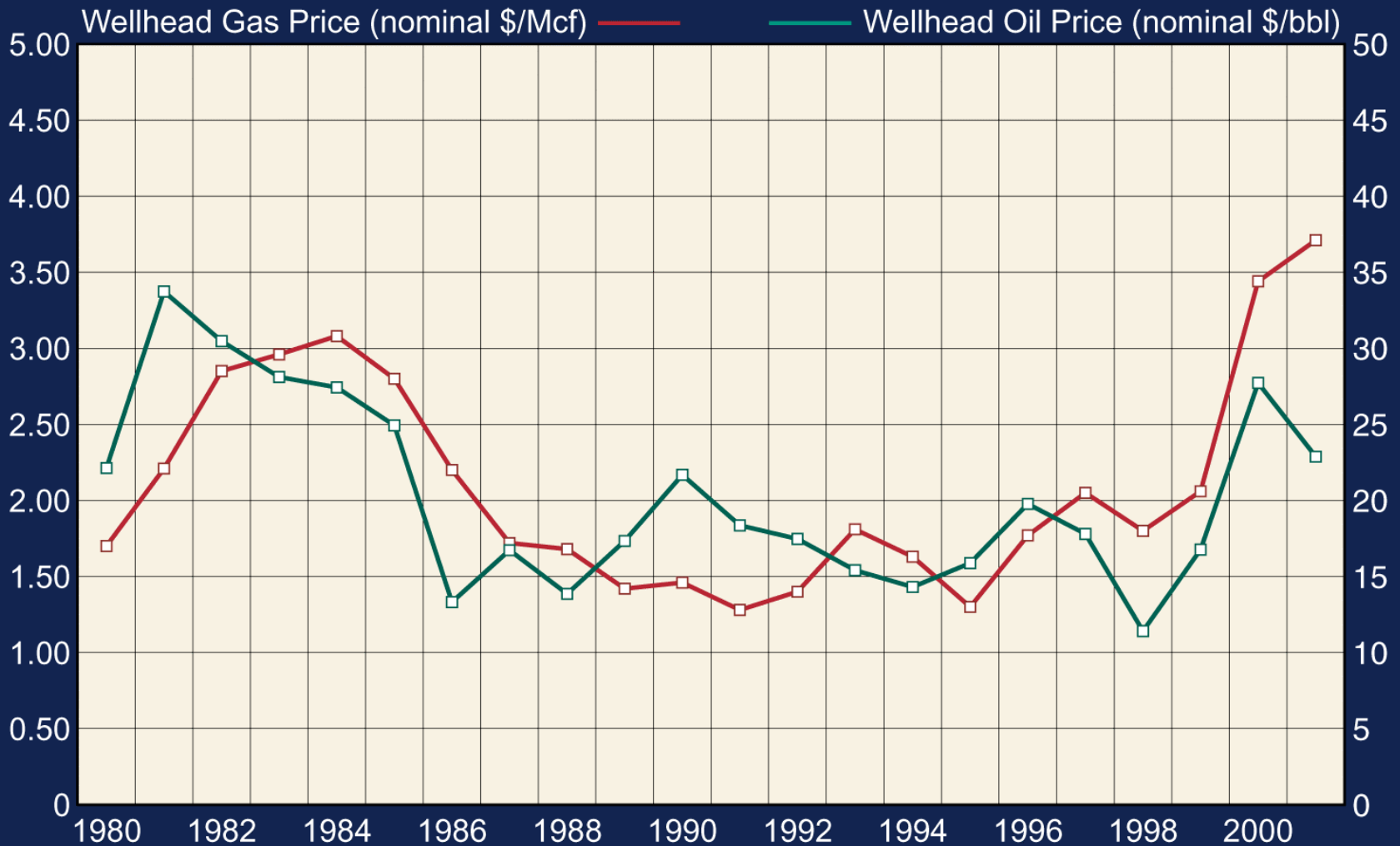


# Wellhead Gas and Oil Prices, L48 US



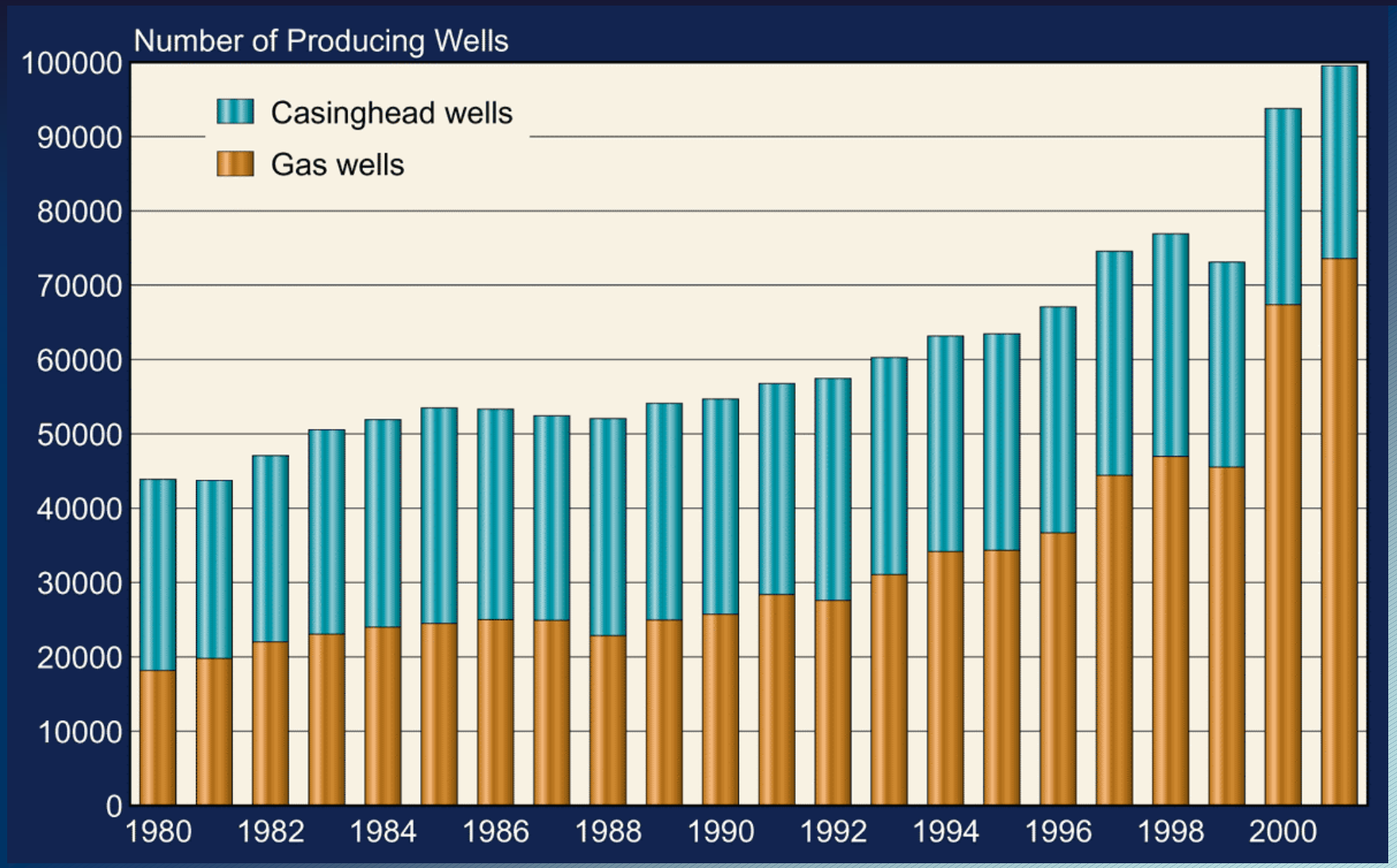
Source: Potential Gas Committee (2003). Data from EIA.

# Wellhead Prices, Rocky Mountain Region



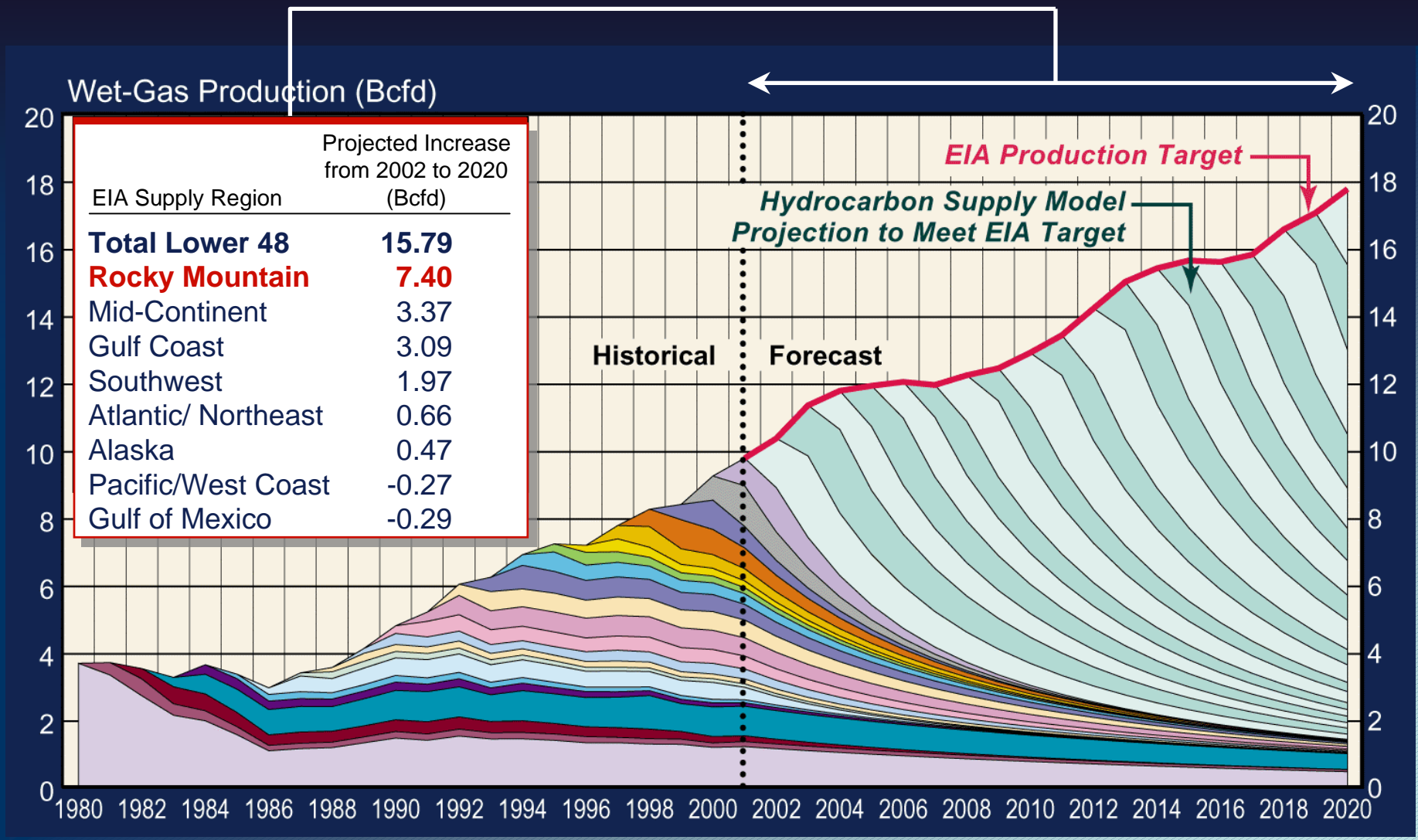
Source: Potential Gas Committee (2003). Data from EIA.

# Producing Wells, Rocky Mountain Region

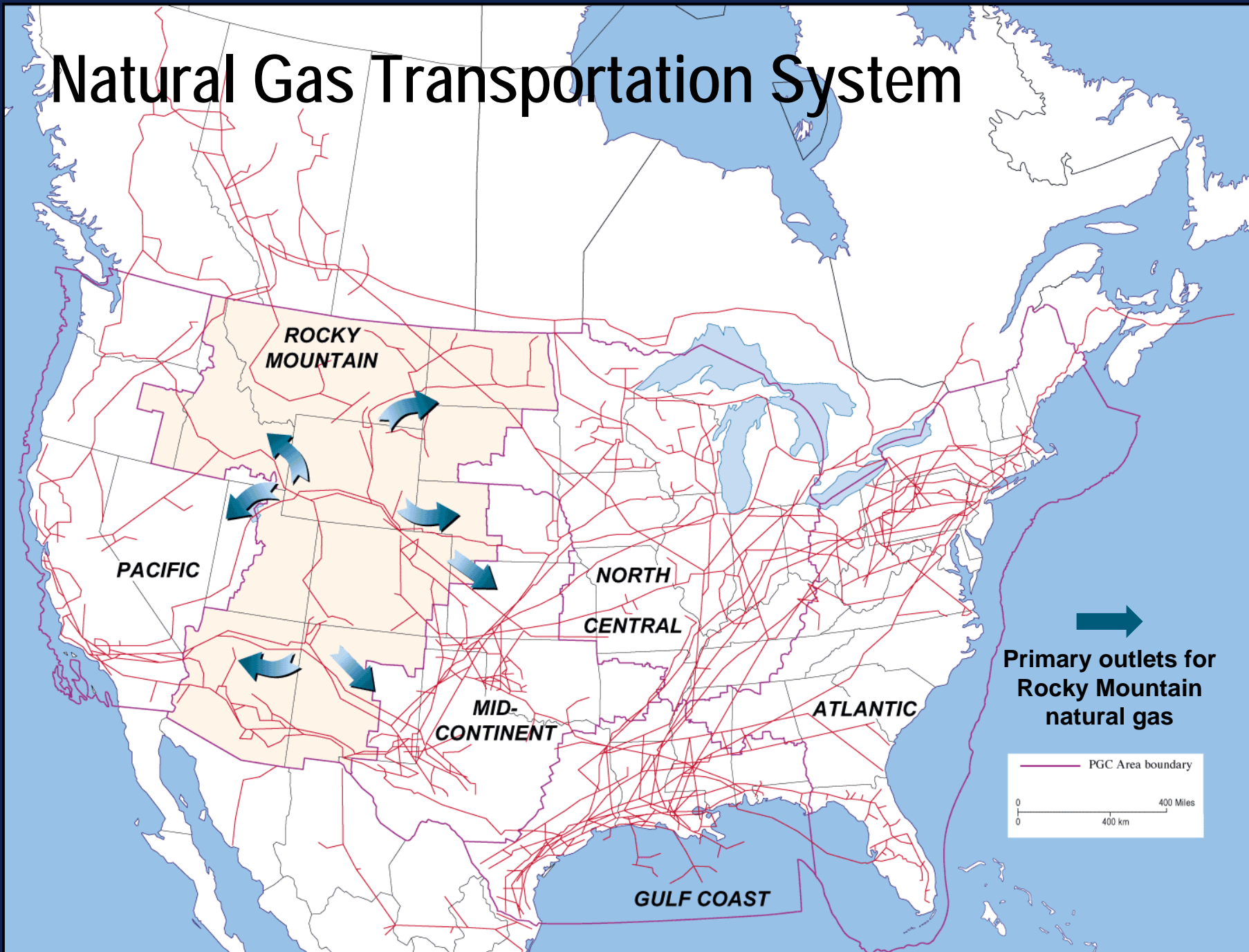


Source: Potential Gas Committee (2003). Data from EIA.

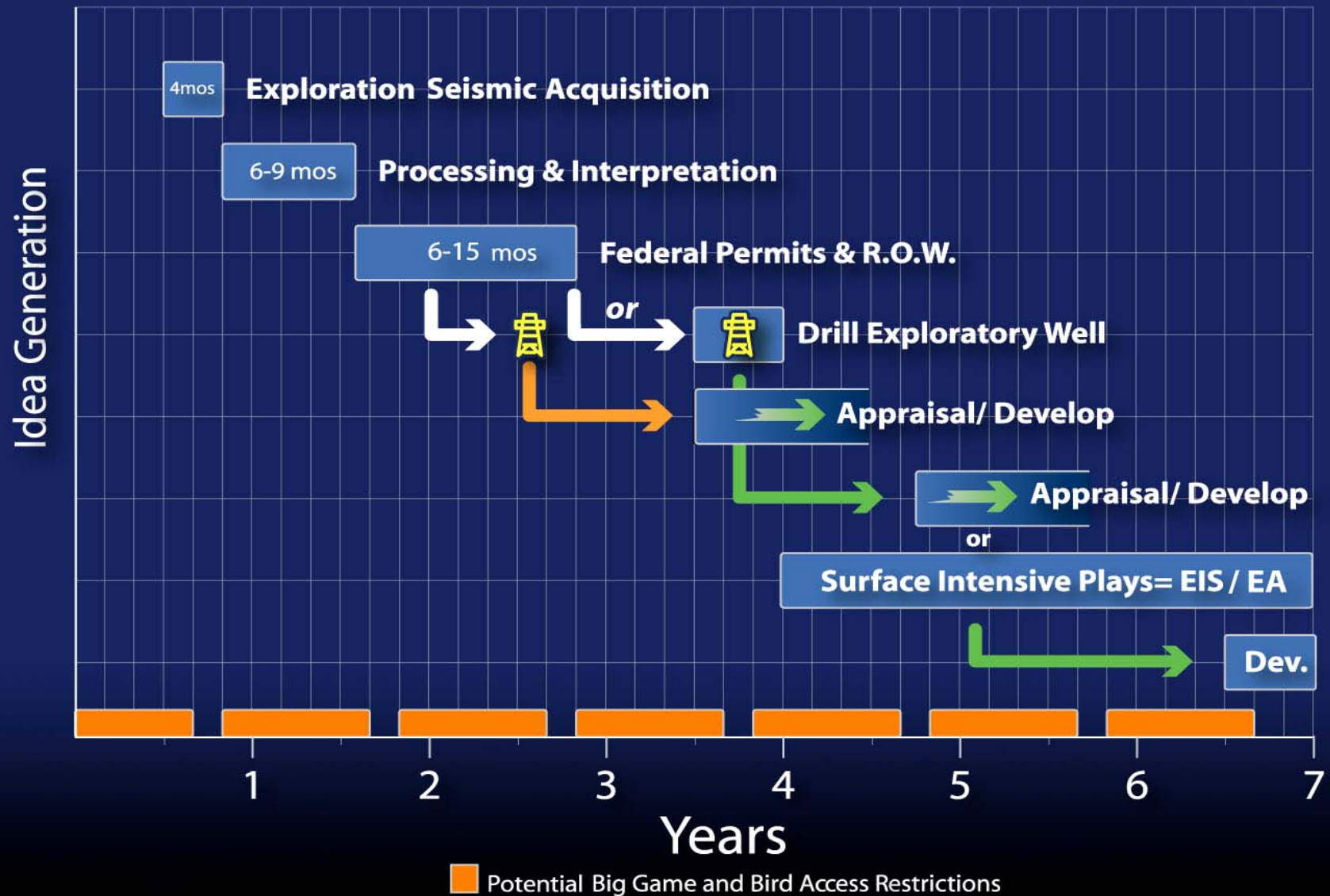
# Rocky Mountains Production Forecast



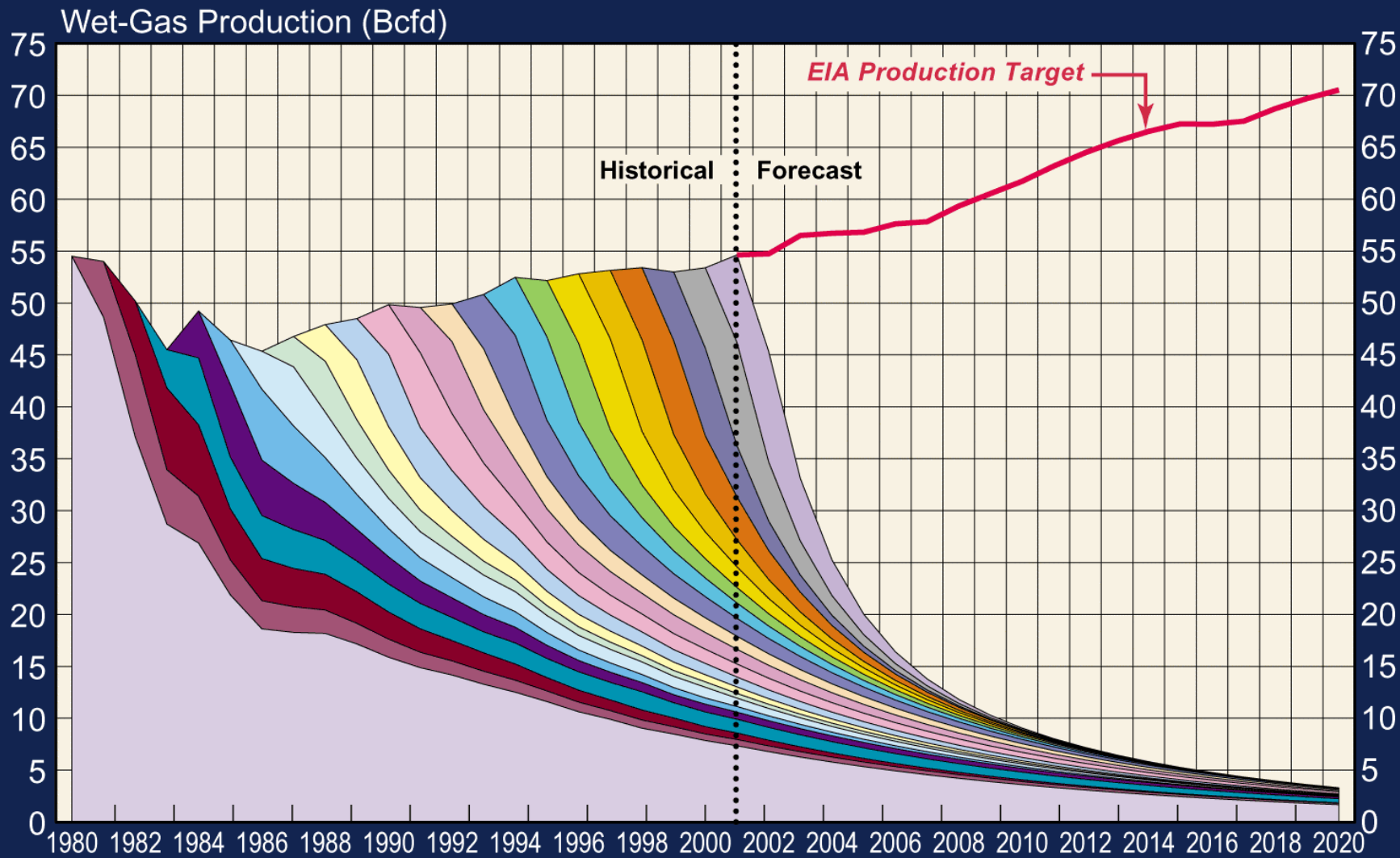
# Natural Gas Transportation System



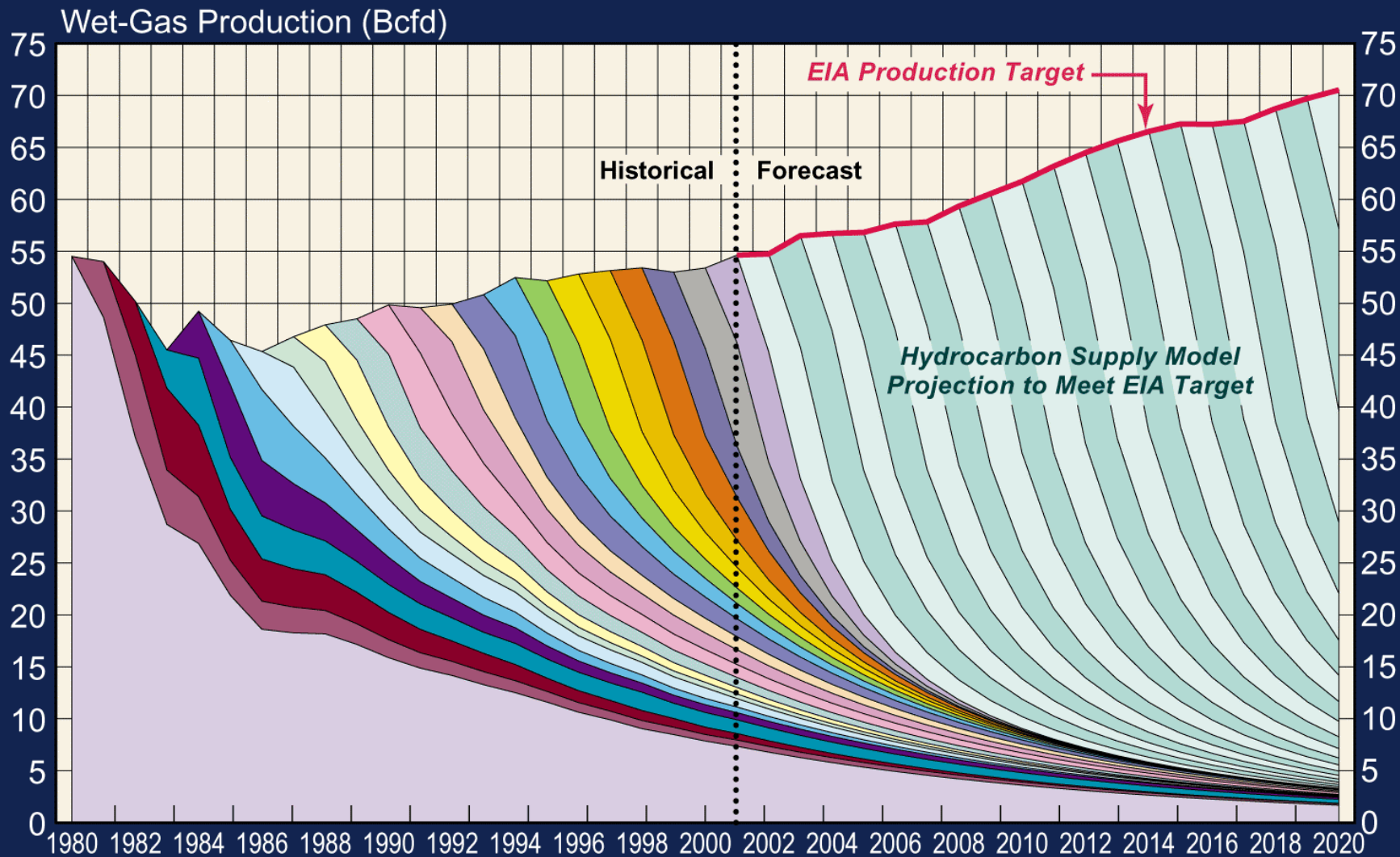
# Rockies Resource Development Time-Line



# L48 Natural Gas Production and Forecast

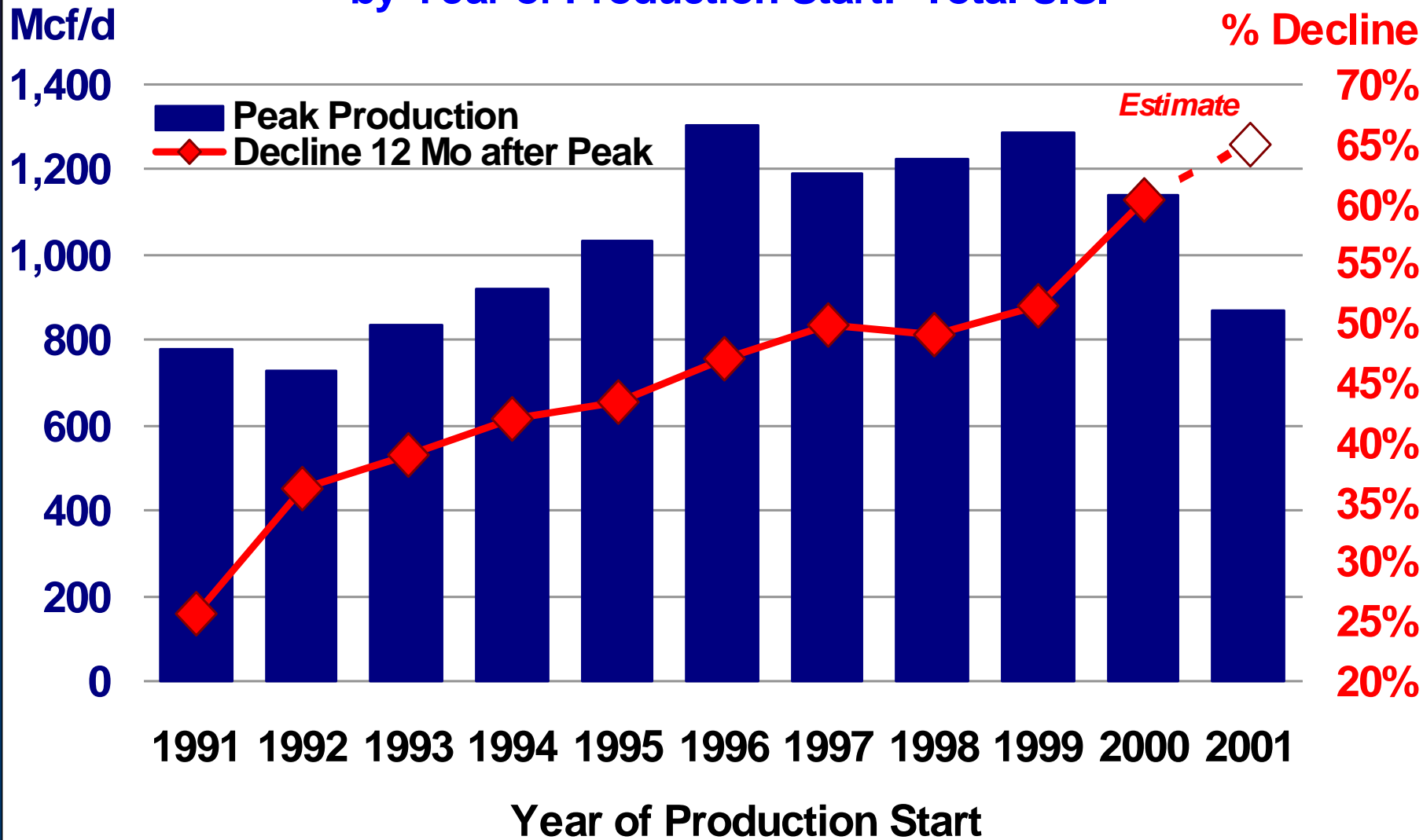


# L48 Natural Gas Production and Forecast



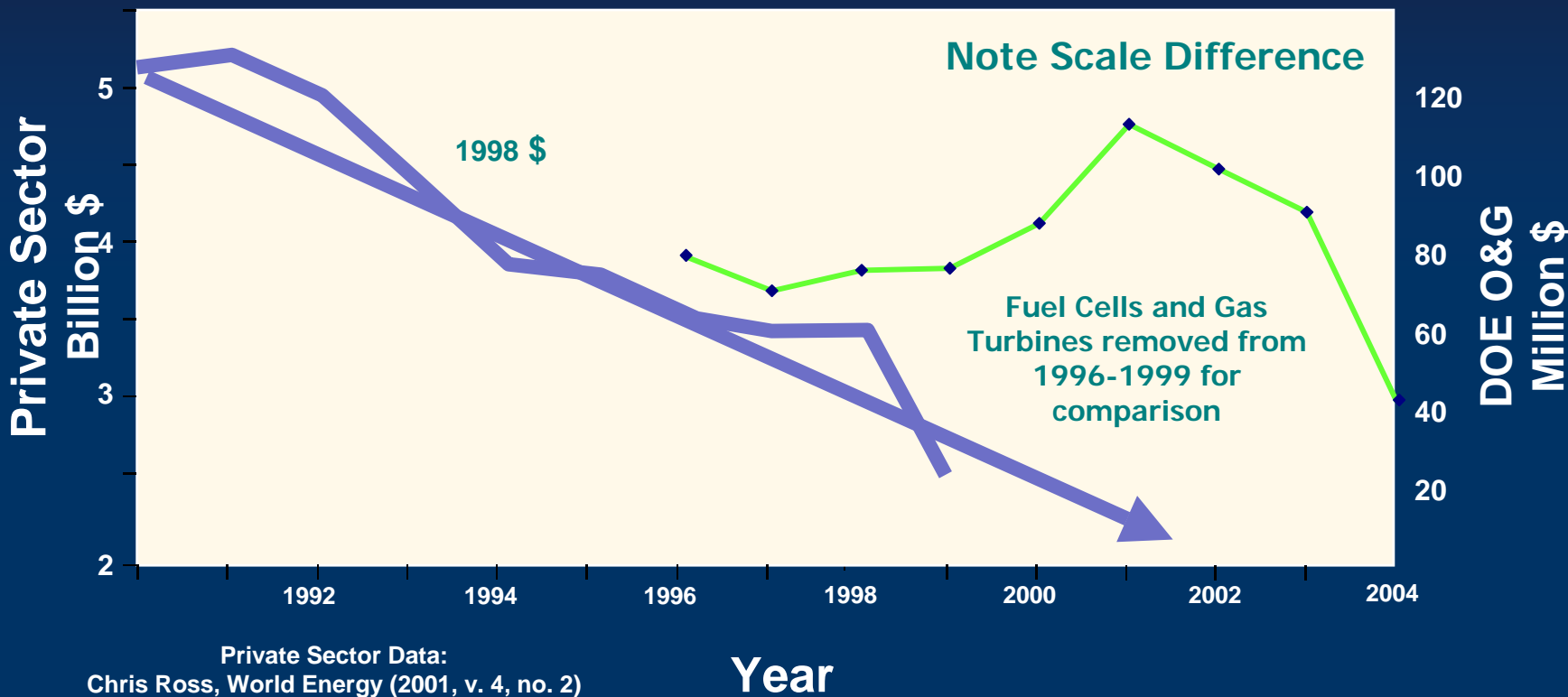


## Average Peak Production & First Year Decline per Well, by Year of Production Start: Total U.S.

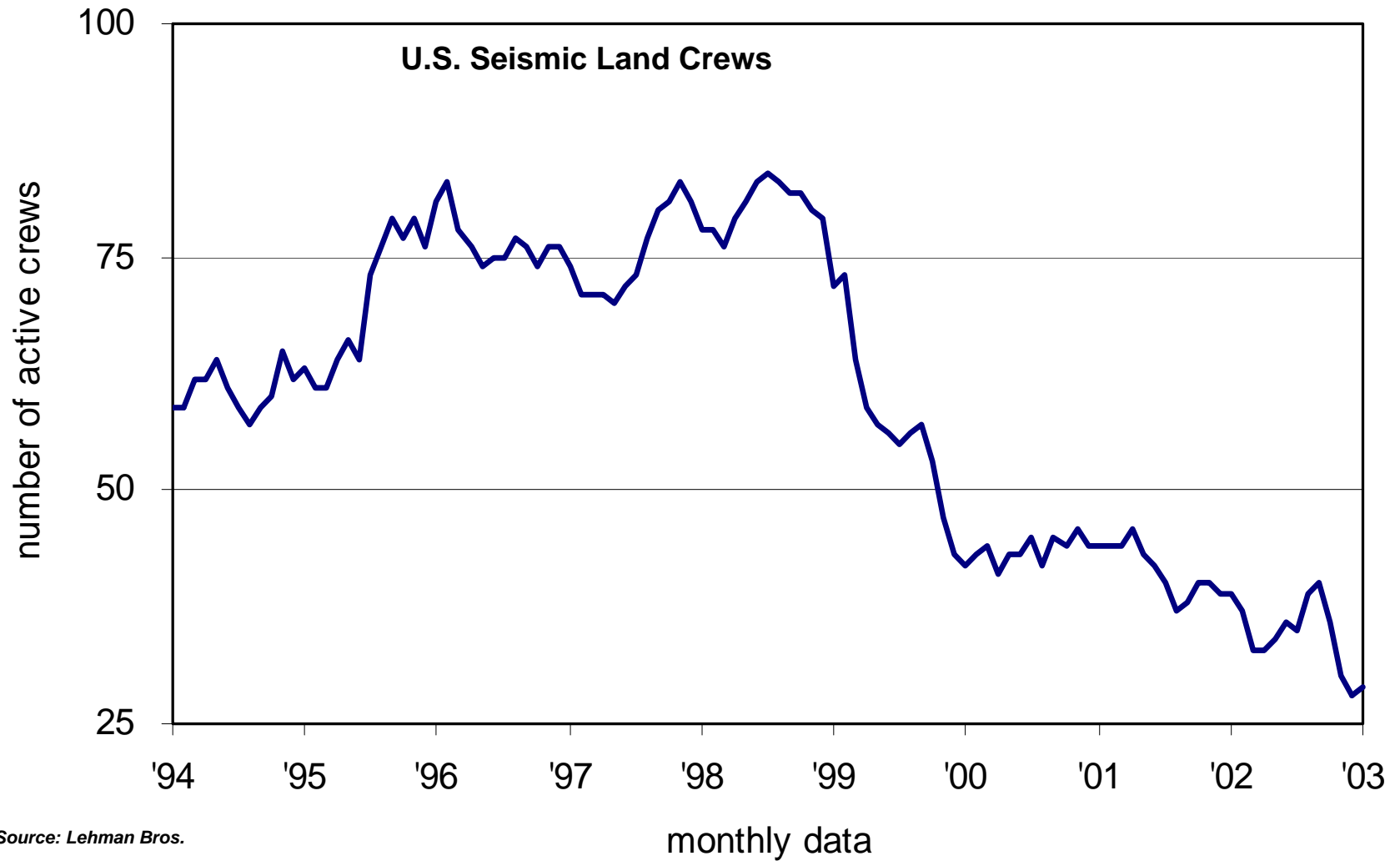


Source: IHS Energy & APC

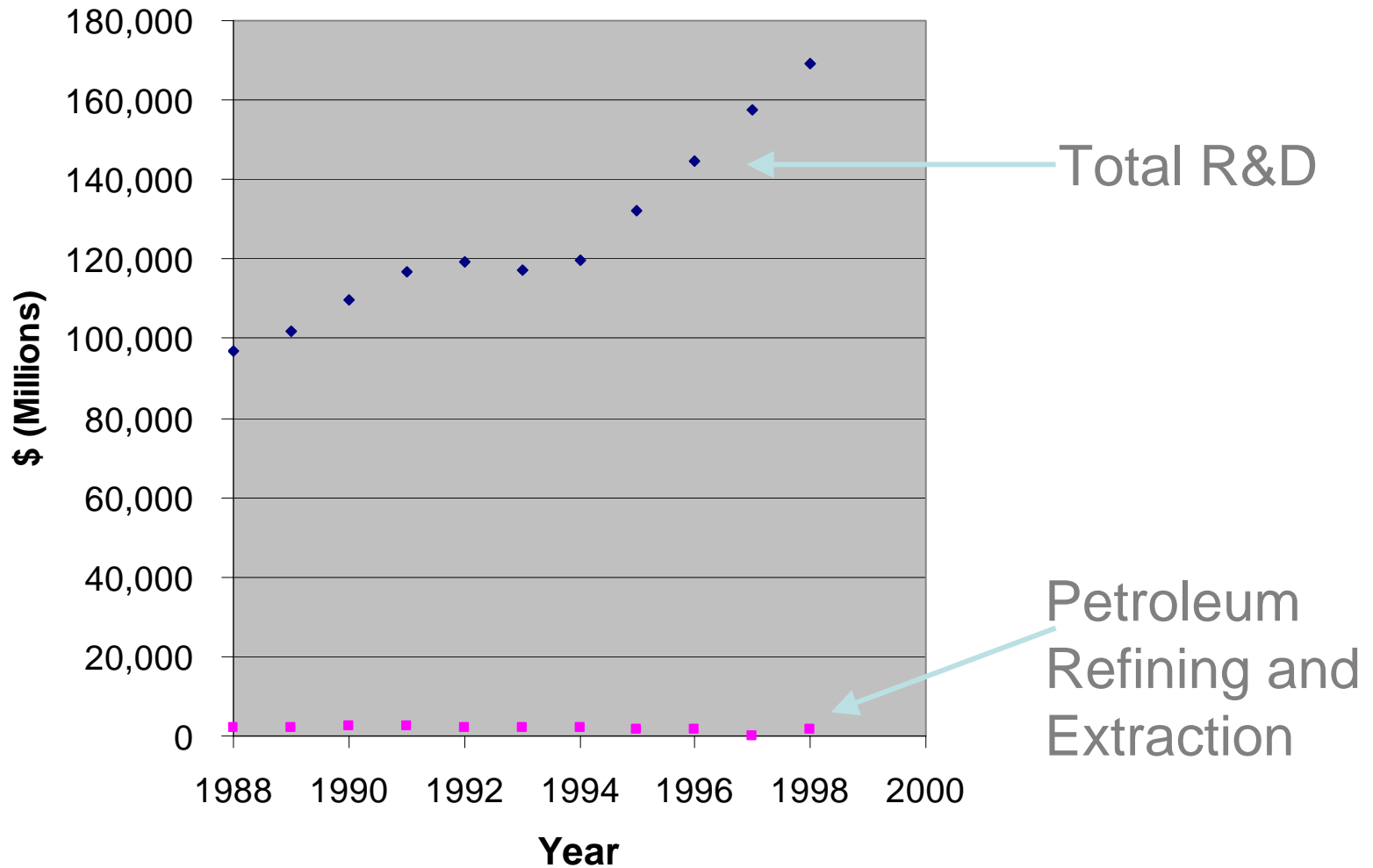
# Meeting Demand - Oil and Gas R&D Funding



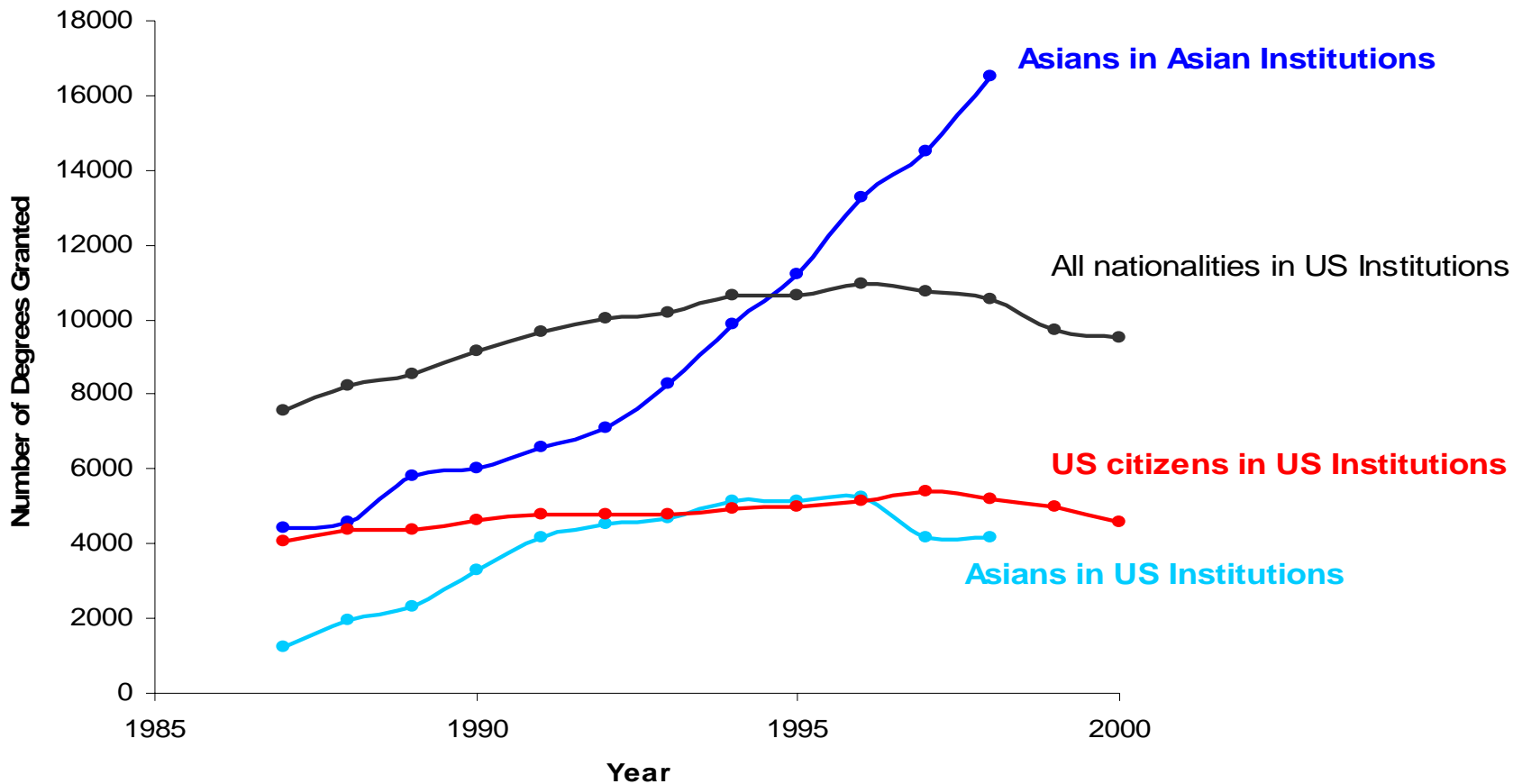
# U.S. Seismic Land Crew Count



# National R & D Dollars



## Doctoral Sciences & Engineering Degrees

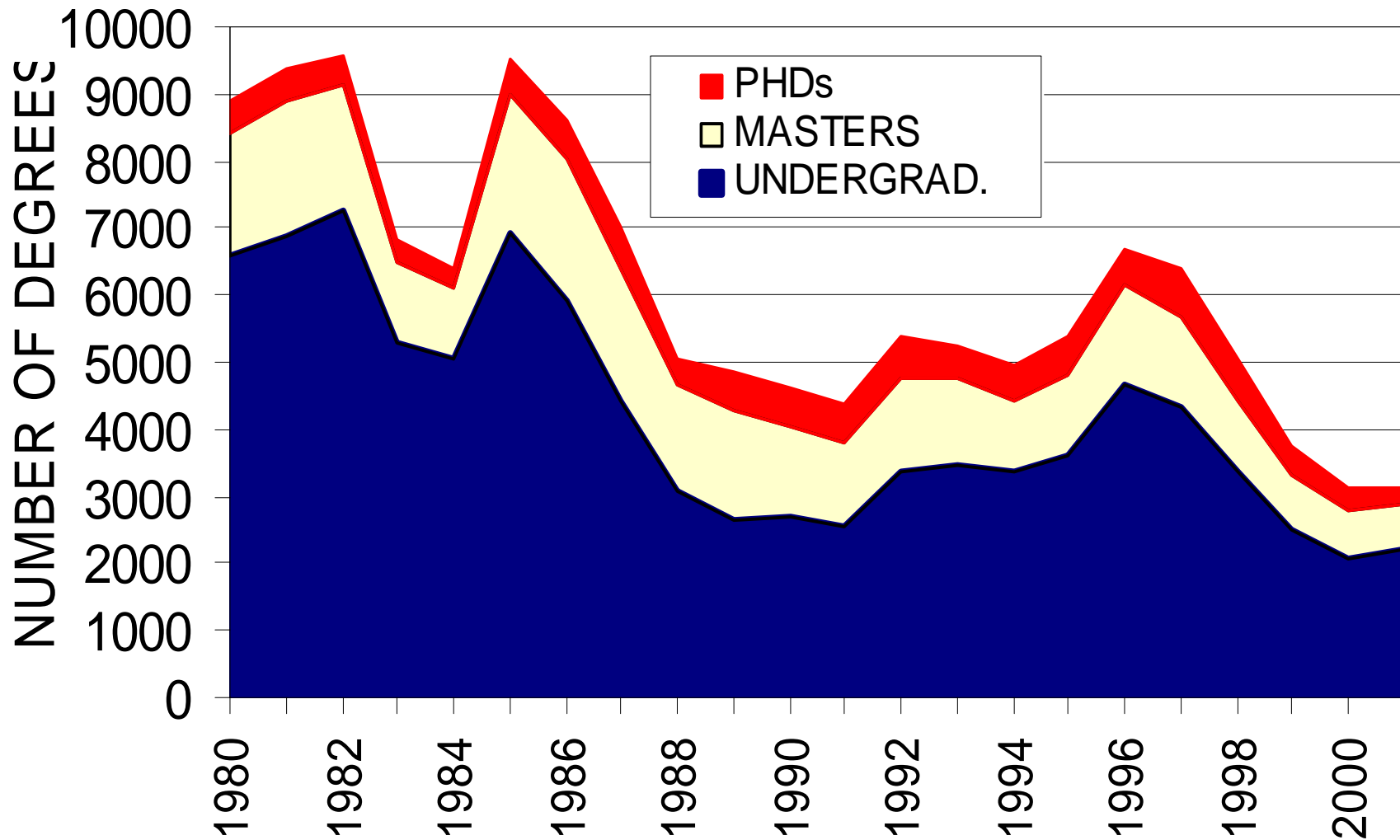


Source: Science and Engineering Doctorate Awards, 1996 and 2000, NSF; Science and Engineering Indicators, NSB, 2002

Sciences = Physics, chemistry, astronomy, earth, atmospheric, and ocean sciences

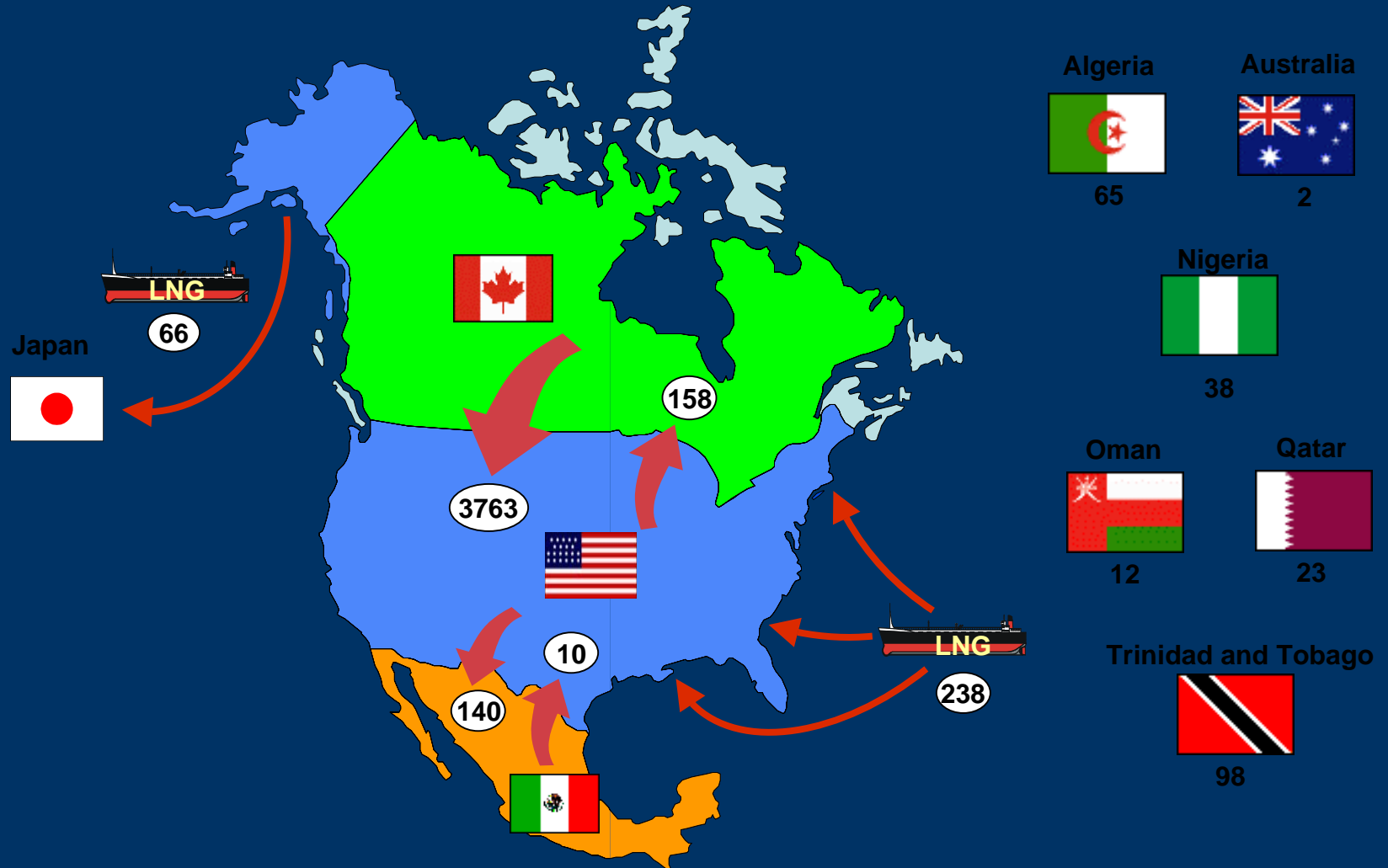
Engineering = Aeronautical, astronautical, chemical, civil, electrical, industrial, material, metallurgical, and mechanical.

# GEOSCIENCE DEGREES GRANTED 1980 - 2001

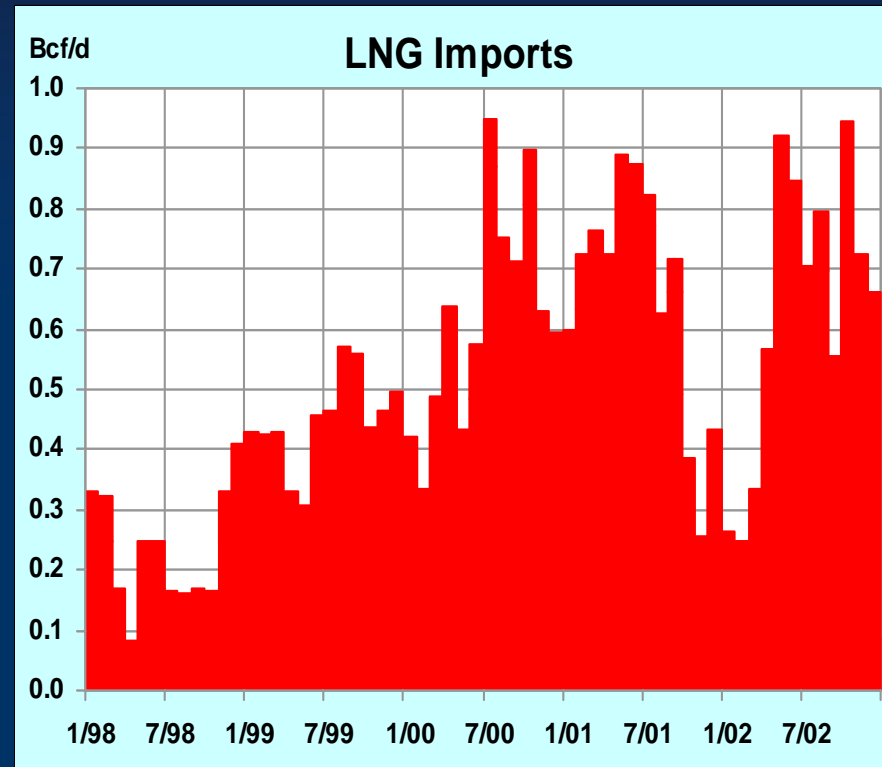
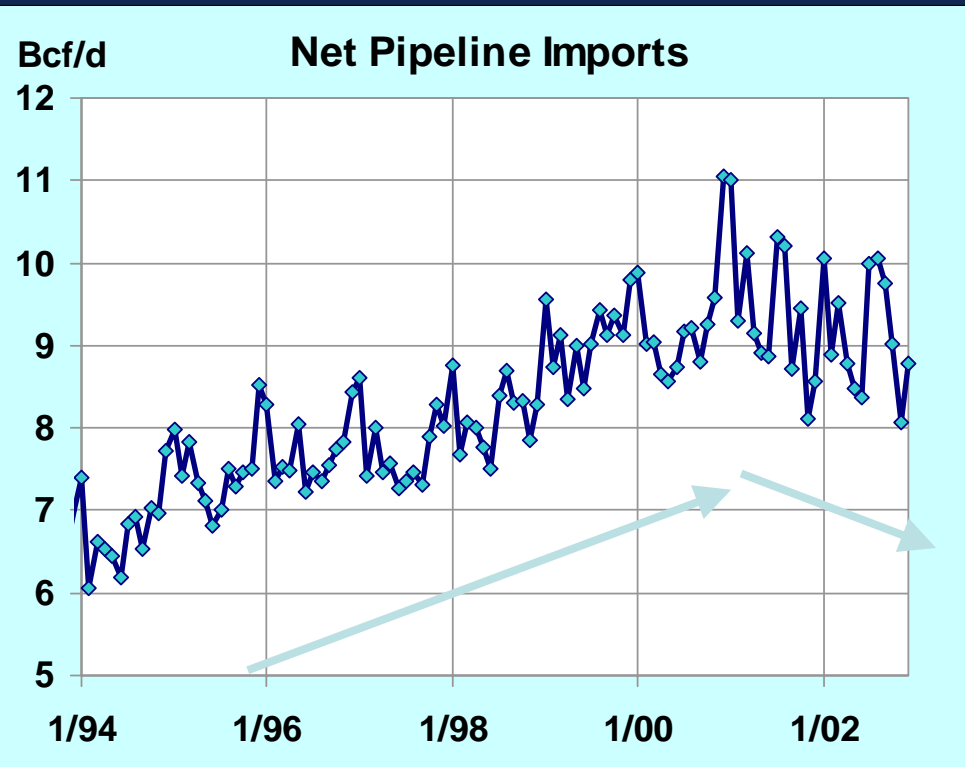


Source: American Geological Institute

# Natural Gas Imports & Exports, 2001 (BCF)



# U.S. Pipeline and LNG Imports



Source: EIA

Figure 4-16

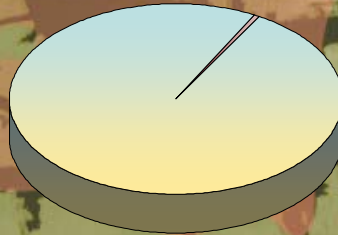


# Ultimate Potential of Natural Gas

TRILLION CUBIC FEET

Remaining  
Produced

North of 60  
175



Other Frontier\*

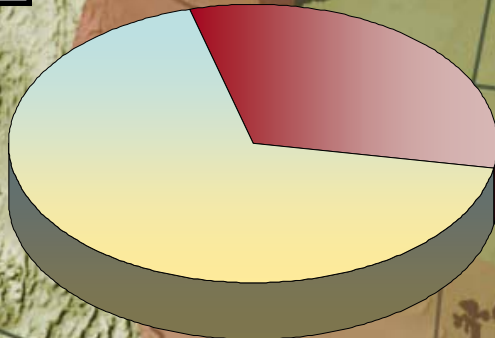
89

includes other regions offshore  
east coast & west coast

British  
Columbia  
50



Alberta  
270



Grand Banks  
and Scotian Shelf  
63

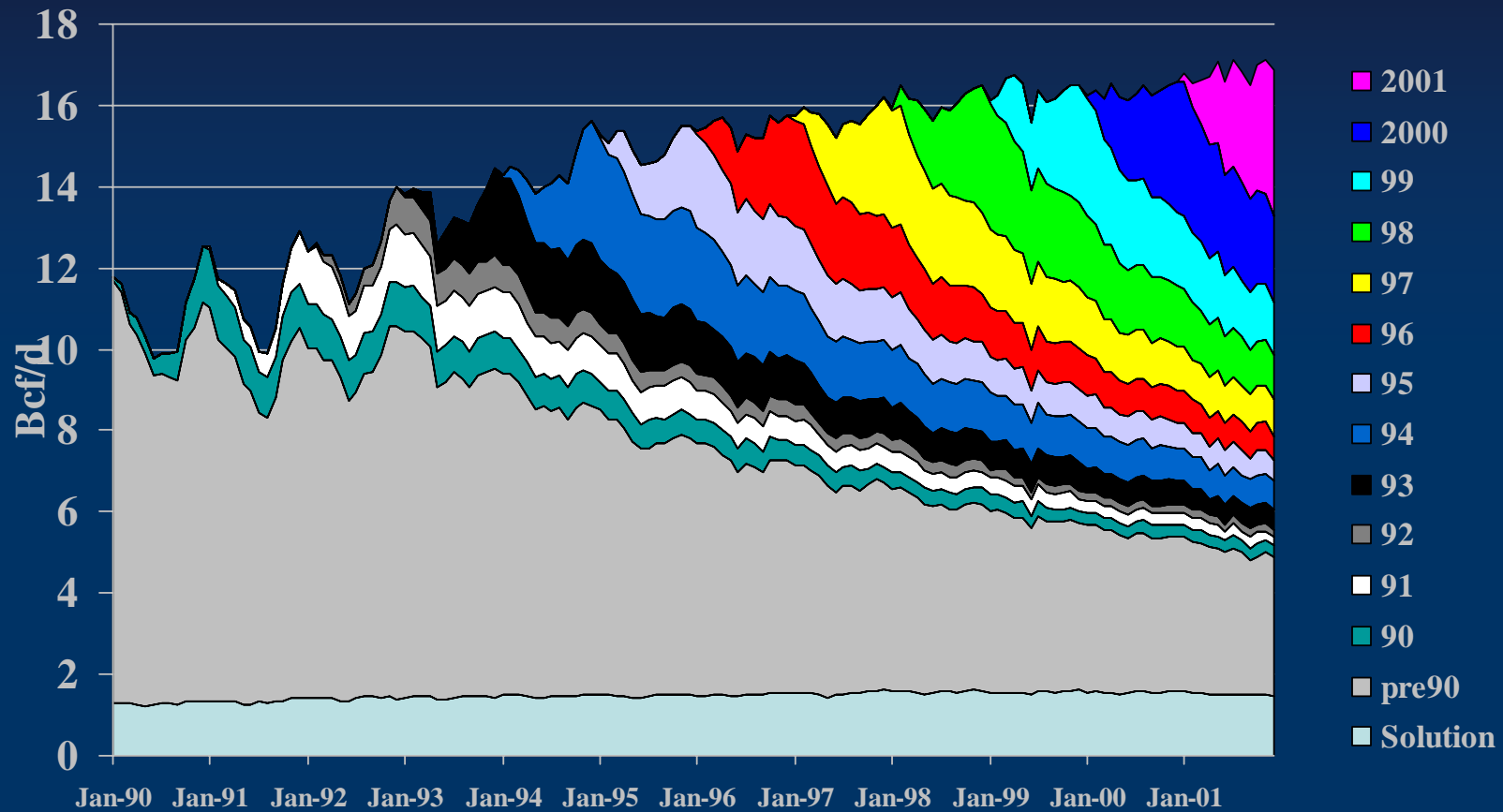


Saskatchewan  
9



Source: NEB

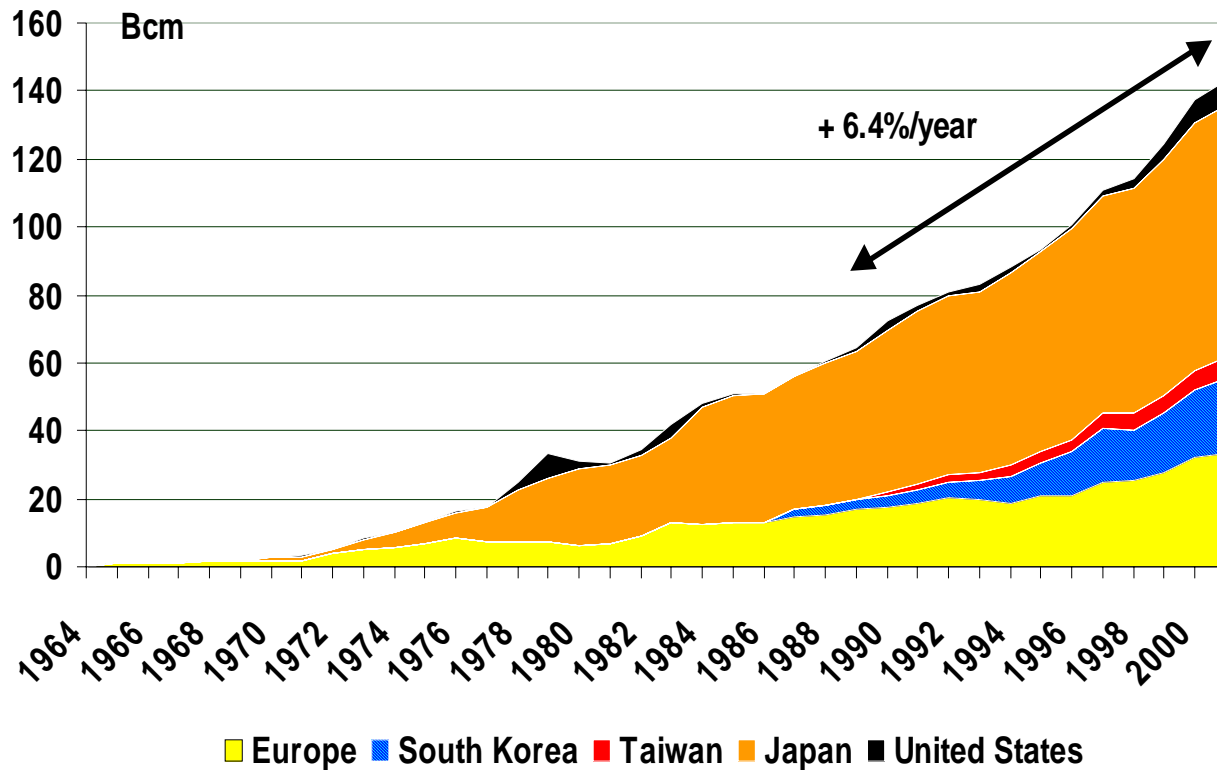
# WCSB Marketable Gas Production Grouped by Connection Year



NEB - Short Term Natural Gas Deliverability - Dec 2002

# World LNG Trade 1964-2001

Figure 3 - Evolution of LNG trade  
(Billion cubic metres)

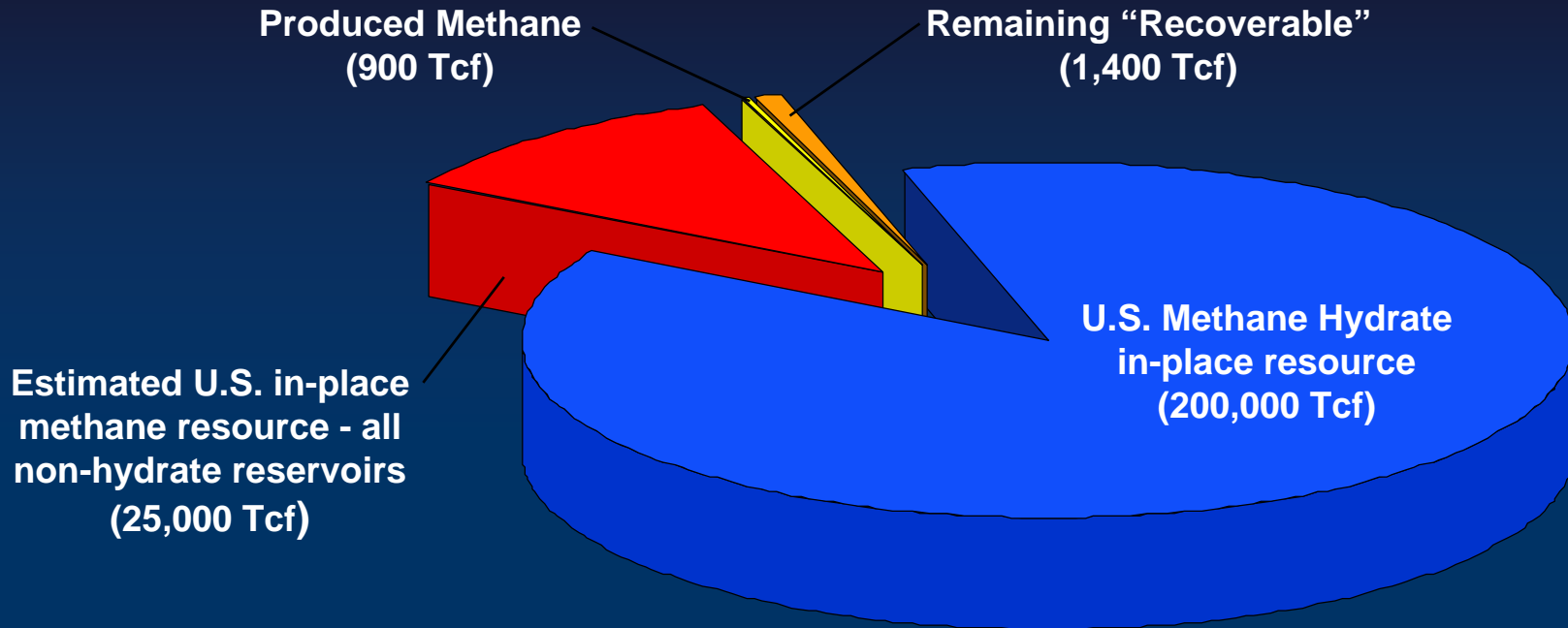


Source: Cedigaz

# North American LNG Plants



# Hydrate Resource



- If 1% of hydrates are recoverable: 2,000 Tcf
- Conventional Natural Gas Technically Recoverable Resource: 1,400 Tcf



Potential Gas Agency