

# Natural Gas Price Volatility: Causes, Implications and Solutions

**DOE/EIA NEMS Conference**

**March 12, 2002**



Photo Credit:: BBC News - Deutsche Bank trader

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## **Volatility Has Been Increasing**

**40% (annualized monthly) in 1990**  
**Over 60% in 2001**

## **Major Drivers**

**Shifting supply/demand fundamentals**  
**Market deregulation; Politics**  
**Volatility in other fuels and weather**  
**Speculative activity**

## **Implications**

**Impacts financial performance**  
**Boom-bust cycles; Hinders planning**

## **Offsets**

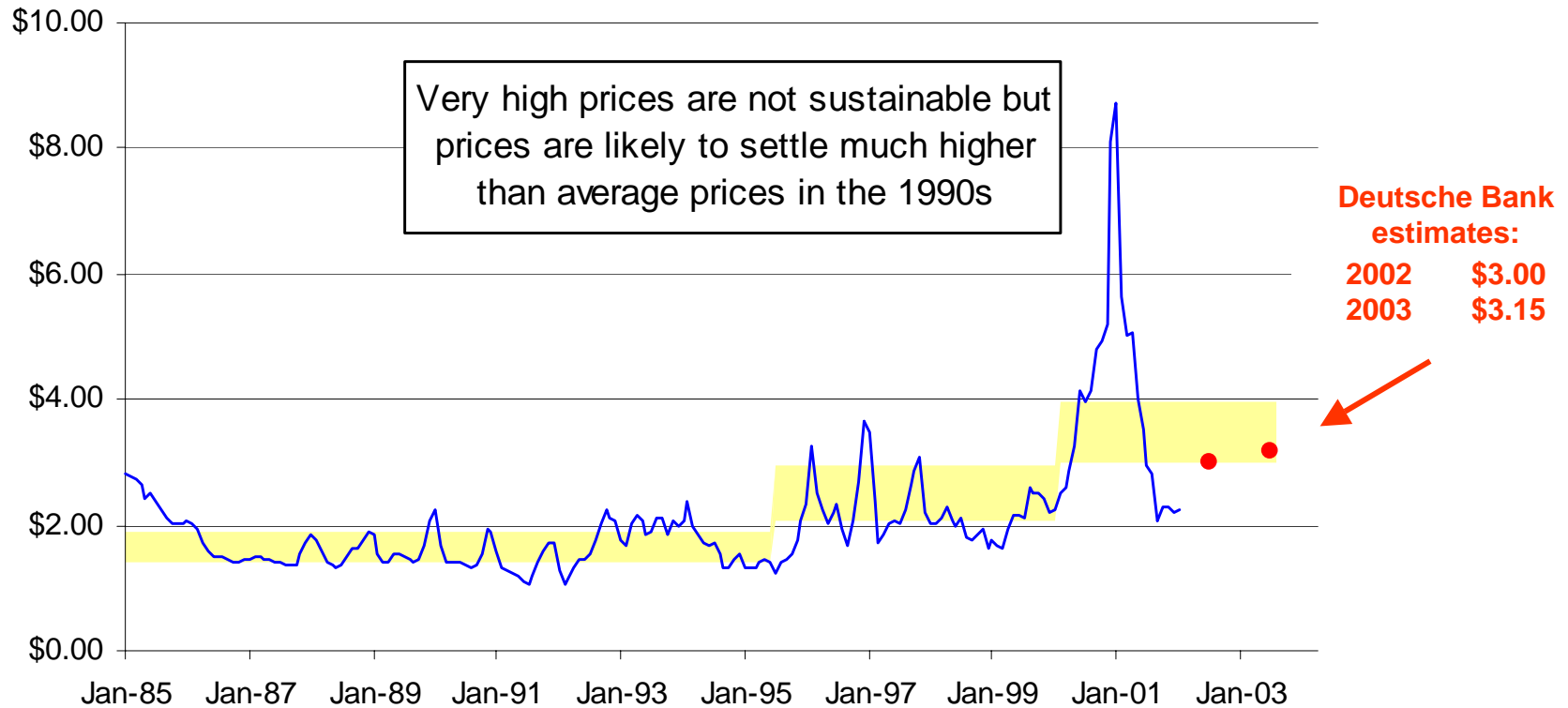
**Size; Integration; Operational Flexibility**  
**Hedging; Contracts; Improved Information**

**Deutsche Bank**  
Deutsche Banc Alex. Brown



# A New Trading Range for U.S. Natural Gas?

...still expecting prices to settle at low-end of \$3-4 range



Source: Natural Gas Week; Deutsche Bank estimates



# Importance of Gas Price Volatility

...complicates ability to plan and budget

- Affects the **financial performance** of producing companies and **stability of income** of producing governments
- Accentuates upstream **boom and bust cycles**, resulting in over-investment and under-investment
- Hinders the ability of industrial users (fertilizer, petrochemicals, metals, paper etc.) and electric generators to plan purchases, thereby **slows the corrective mechanism for pricing**

Source: Deutsche Bank (after Edward Morse, Hess Energy Trading)



# What Is Natural Gas Price Volatility?

...a measure of historical variability and risk

- A combination of
  - Magnitude
  - Duration
- Common Sense Notion: rapid and radical price changes, as occurred in the run-up from \$2 in early 1999 to \$10 in late 2000, and back to \$2 in 2001
- Technical Definition: the annualized standard deviation of percentage changes in daily futures prices

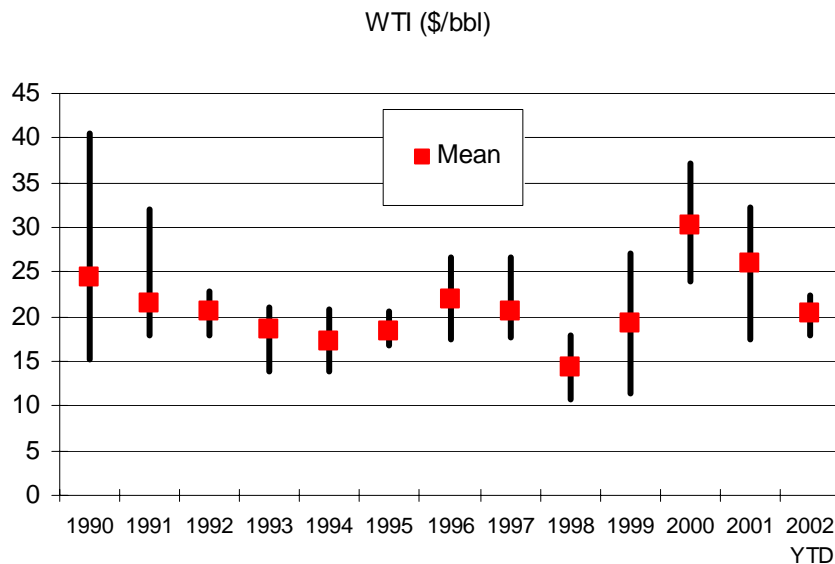
Source: Deutsche Bank (after Edward Morse, Hess Energy Trading)



# U.S. Crude Oil and Natural Gas Prices 1990-2002

...oil: volatility at the start and end of the decade;

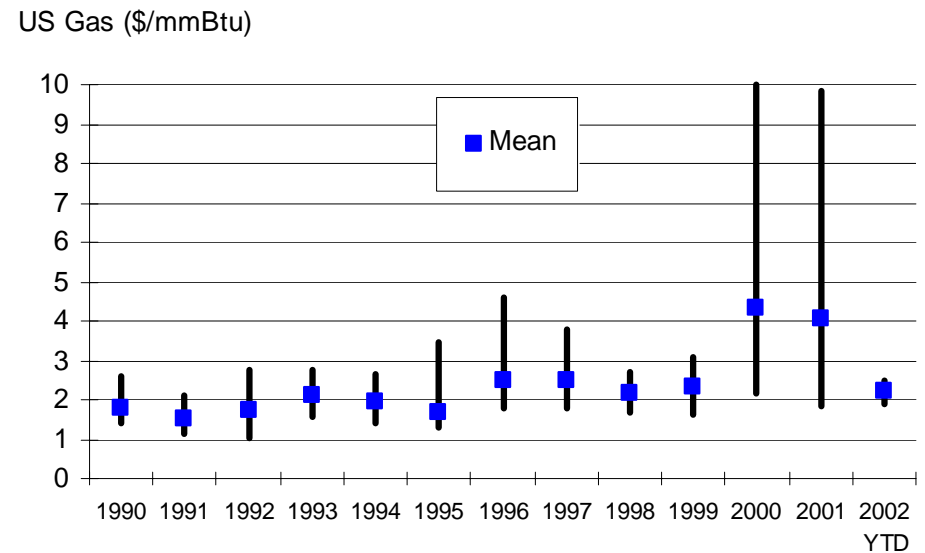
...gas: unprecedented volatility in 2000-2001



Source: Nymex; Bloomberg

Saudi Arabia as a buffer?

Source: Nymex; Bloomberg; Deutsche Bank (YTD March)



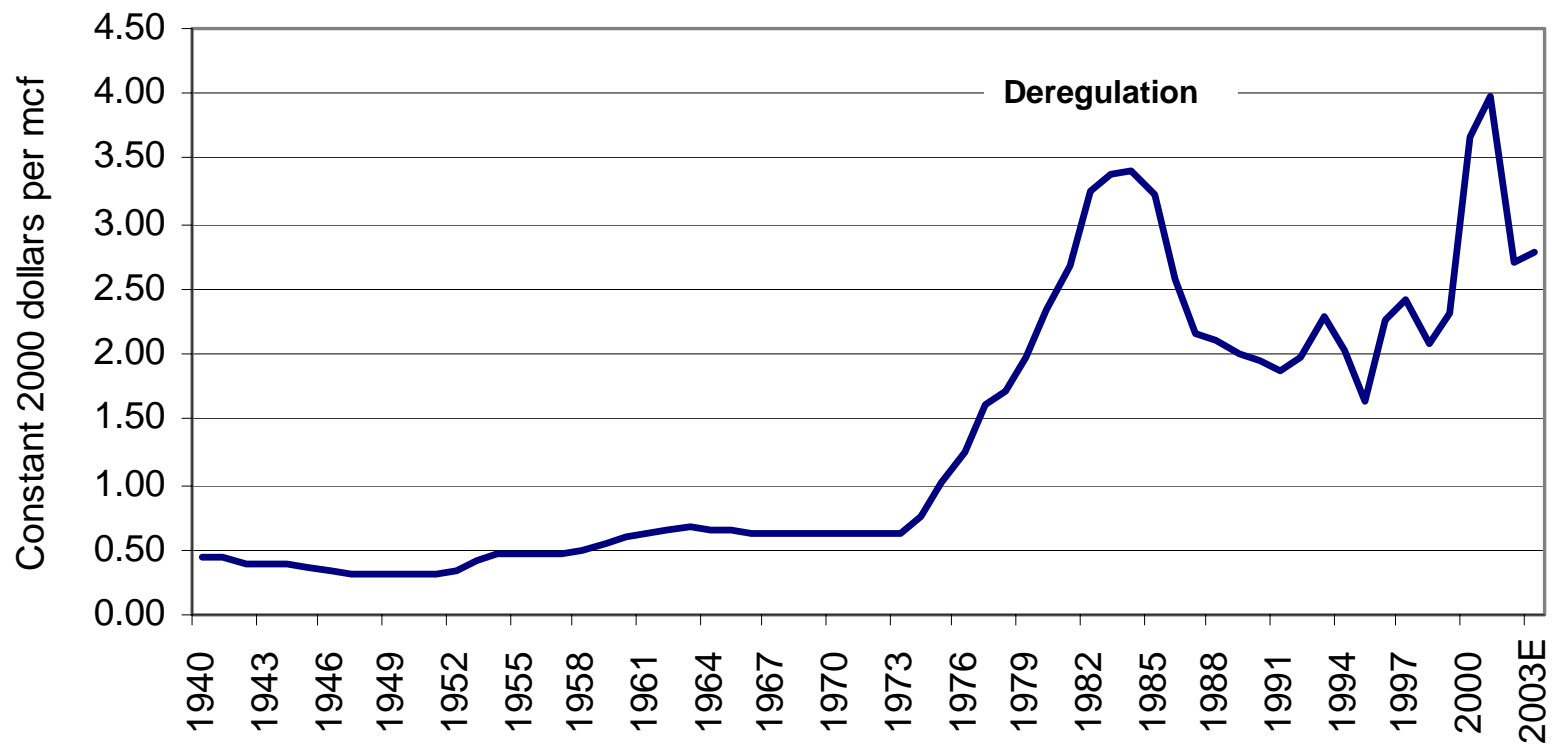
Source: Nymex; Bloomberg

US FERC as a buffer?



# Natural Gas Wellhead Prices (Real \$)

...spike surpassed the mid-1980s peak

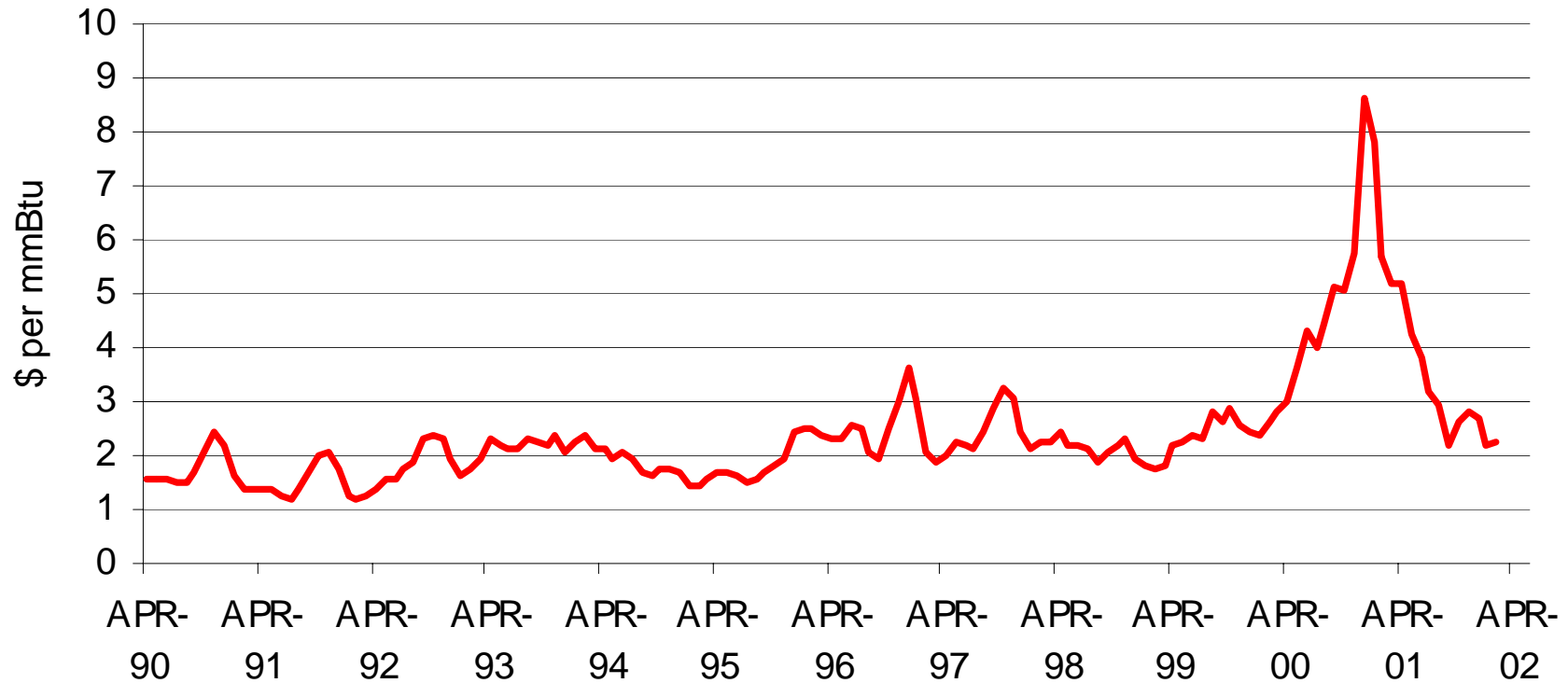


Source: U.S. DOE/EIA; Deutsche Bank estimates



# Natural Gas Prices 1990-2002

...since the start of gas futures trading in April 1990

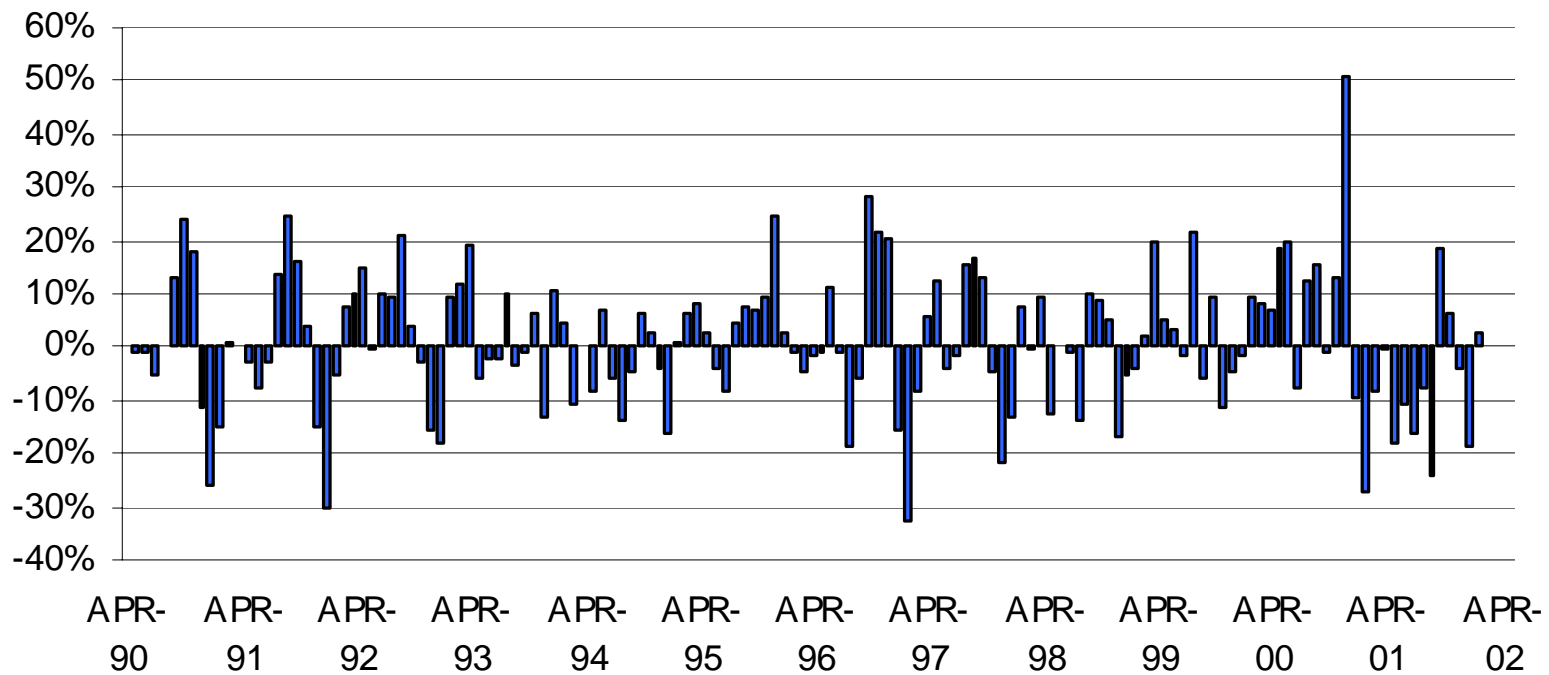


Source: Nymex; Deutsche Bank



# Natural Gas Price % Changes 1990-2002

...monthly volatility appears to be rising



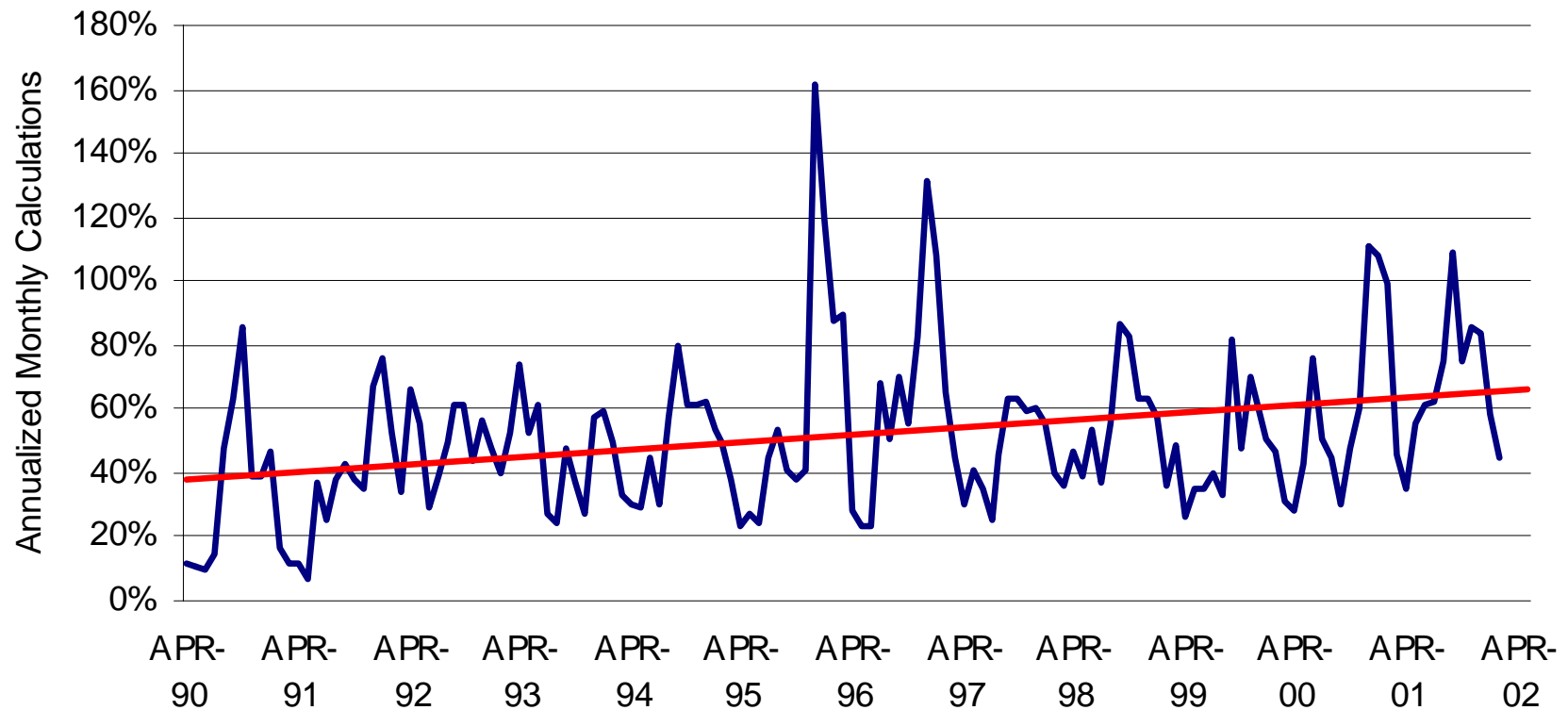
Source: Nymex; Deutsche Bank





# Natural Gas Historical Volatility 1990 - 2002

...technical definition clearly on the rise

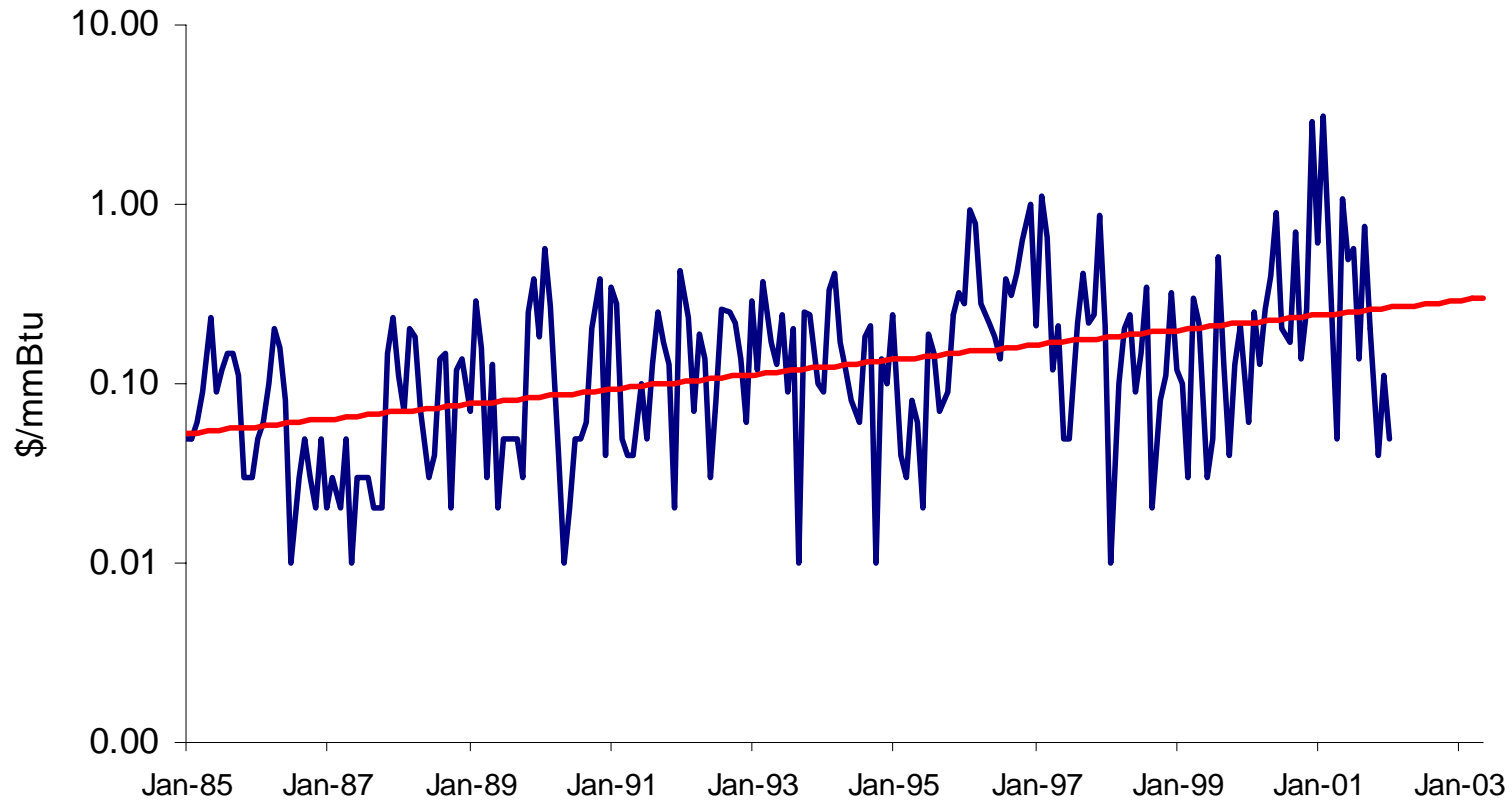


Source: Nymex; Deutsche Bank



# Absolute Monthly Gas Price Change- Log Scale

...under 10¢ in the 1980s to almost 50¢ now



Source: Natural Gas Week; Deutsche Bank



# Root Causes of Gas Price Volatility

...changing fundamentals and changing markets

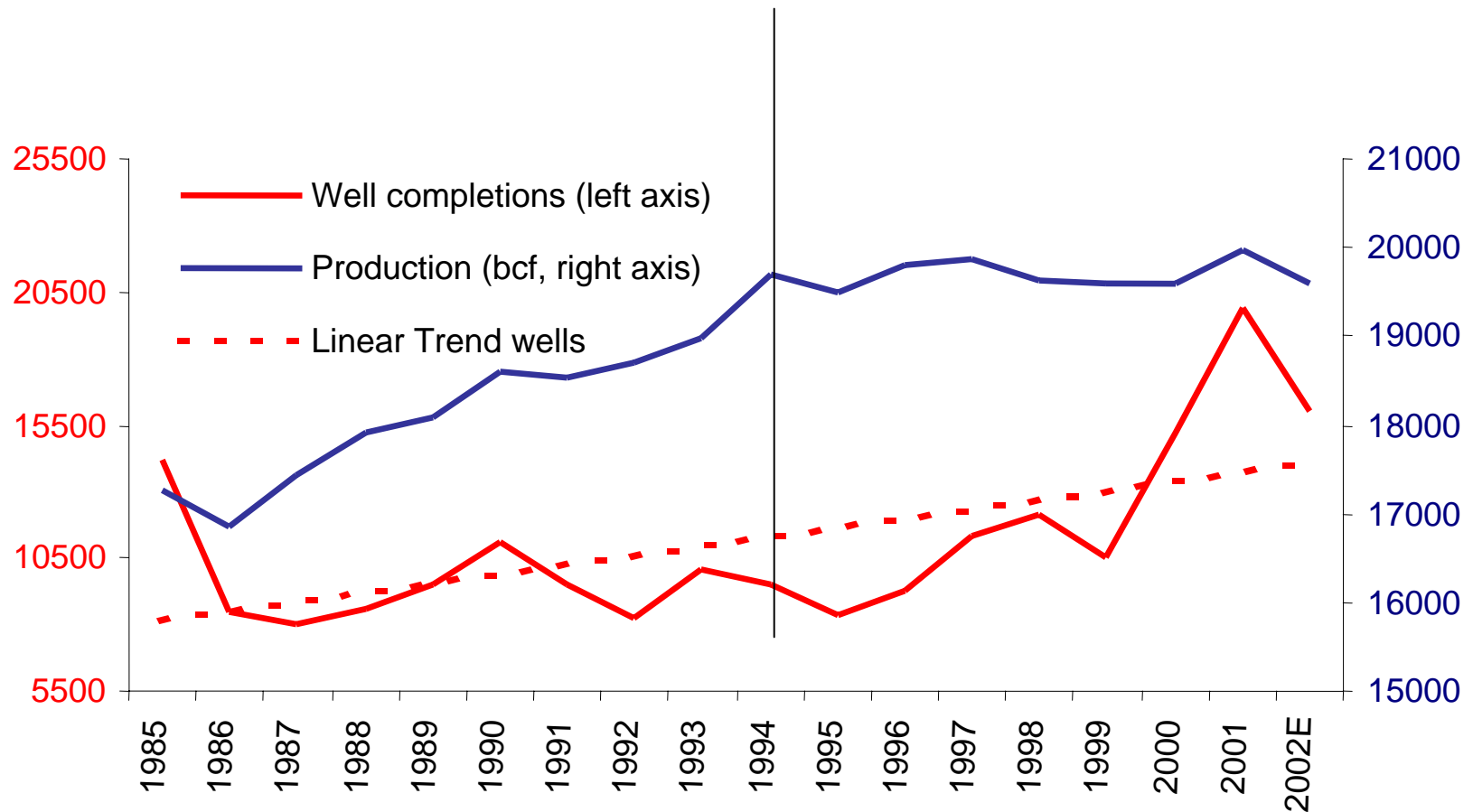
- Fundamentals
  - less production surplus
  - shift in demand to more inelastic users
  - greater variability in temperatures / rainfall
  - more dependence on storage
  - less storage relative to demand
- Market liberalization, deregulation and “politics”
- More volatility in competing fuel prices
- Dynamics of the futures markets

Source: Deutsche Bank (after Robert Mabro, Oxford Energy)



# U.S. Gas Well Completions vs. Gas Production

...production lag suggests shrinking supply surplus after 1994

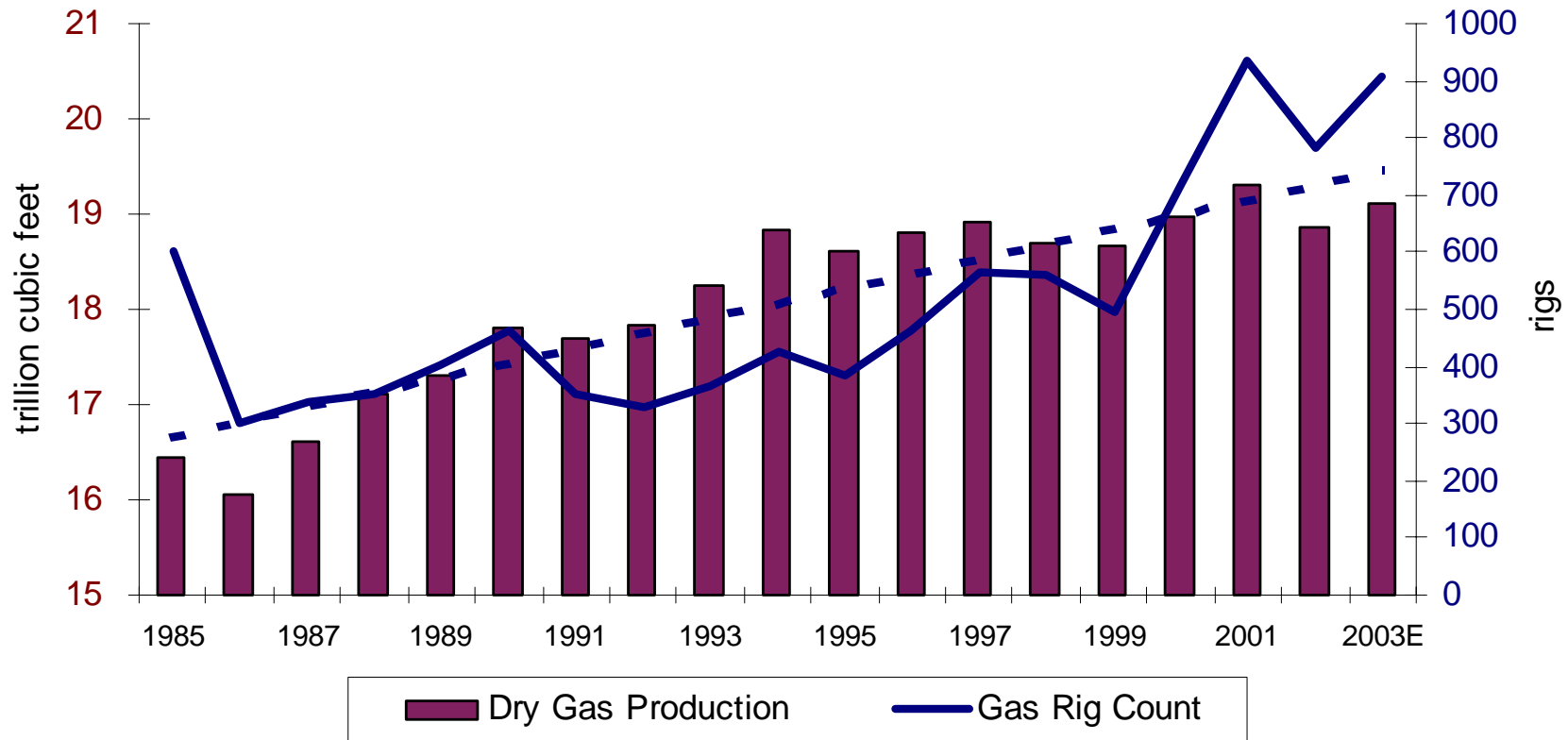


Source: DOE/EIA, Deutsche Bank estimates



# Rig Count and Production Are Related

...individual years differ, but trend lines match

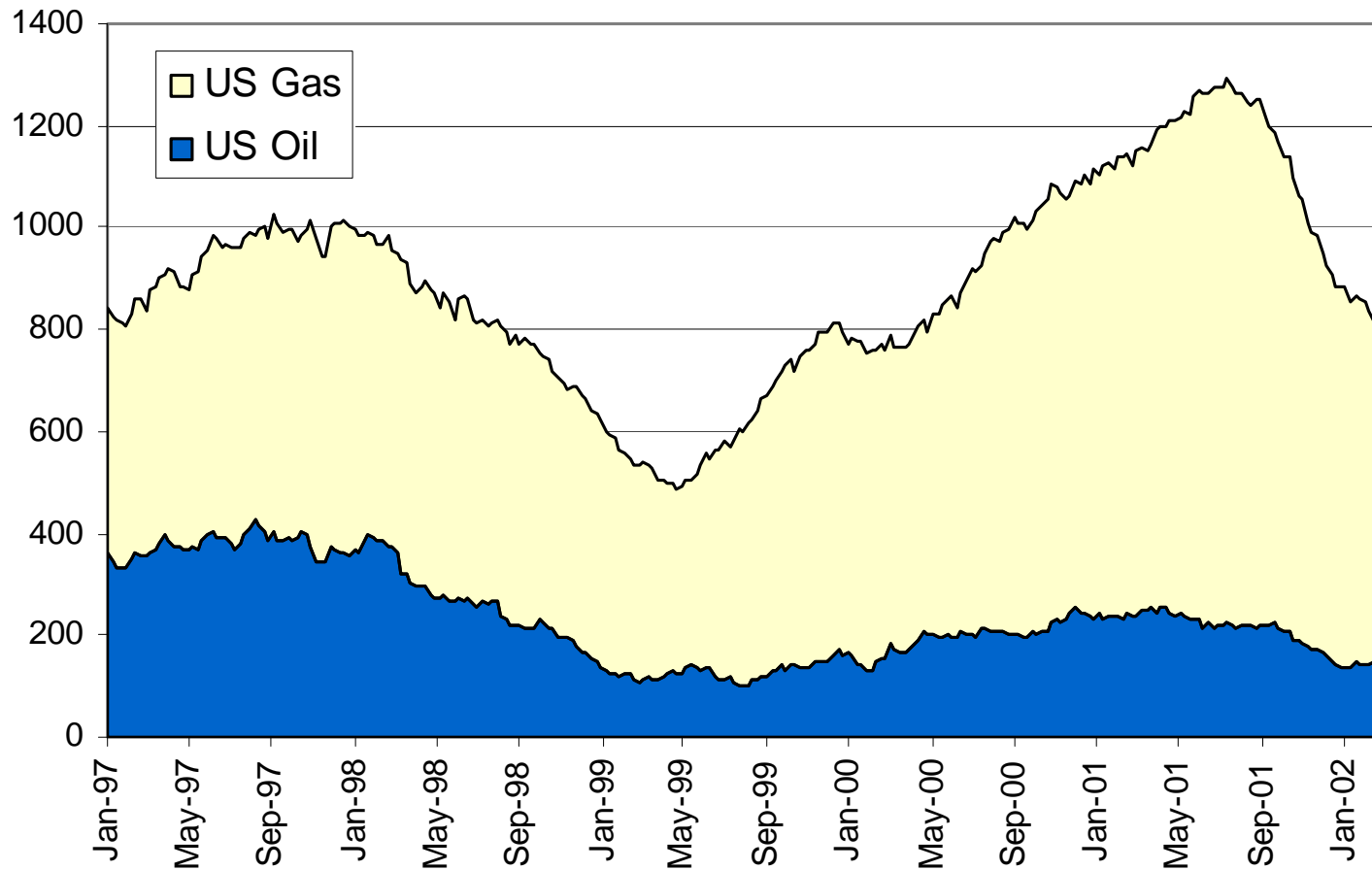


Source: DOE/EIA, Baker Hughes, Deutsche Bank estimates



# Supply Impacted by Shifts in the Rig Count

...lower US gas rig count may constrain supply in 2002-2003



Source: Baker Hughes



# U.S. Gas Demand and Supply

...supply up and demand rebalance in 2002

...focus shifts from NUGs to base industrial use

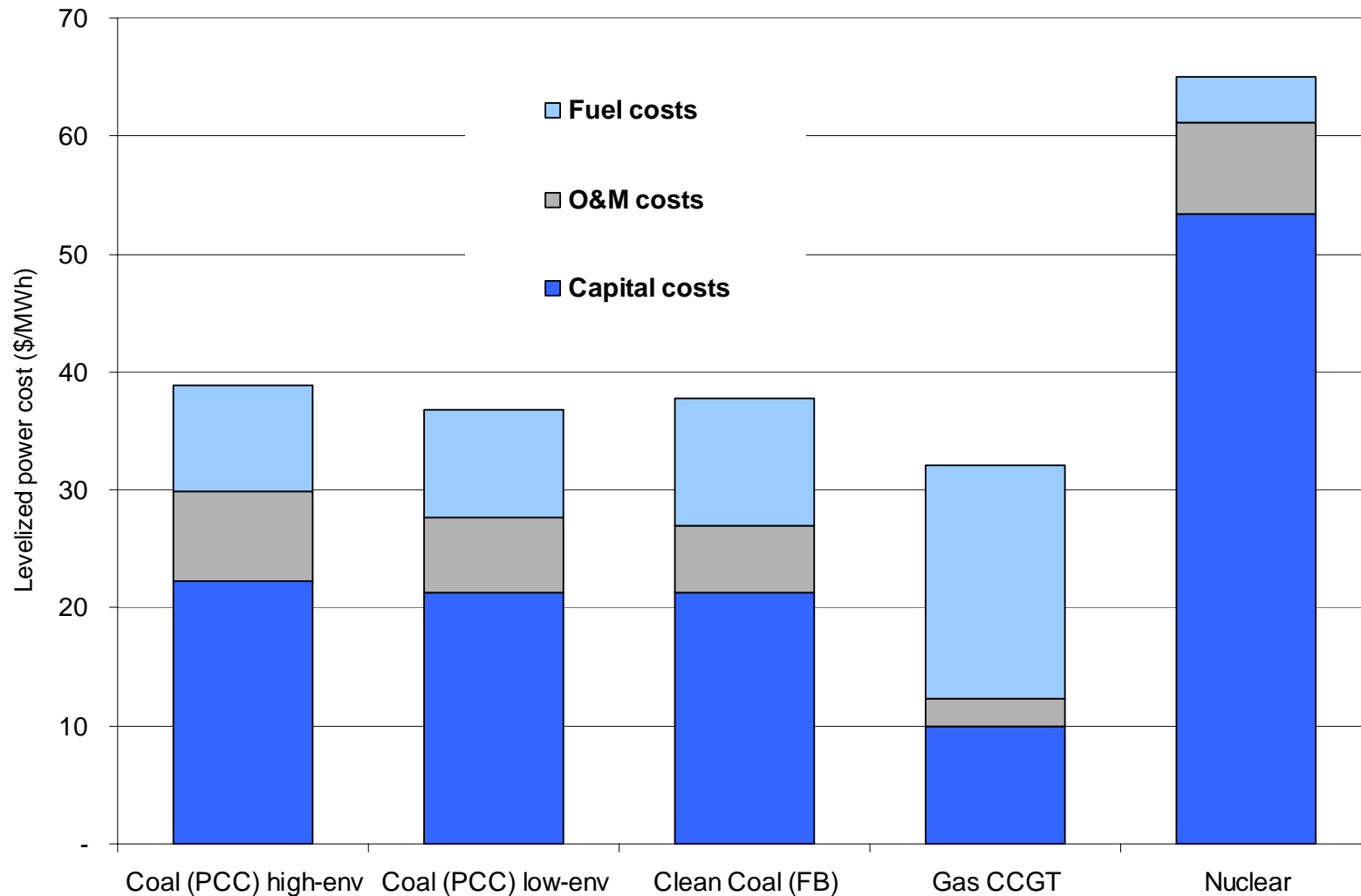
| (bcf/d)                   | 1998        | 1999        | 2000        | 2001E       | 2002E       | 2003E       | Yr% Chg<br>1998-2003 |
|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------------|
| <b>CONSUMPTION</b>        |             |             |             |             |             |             |                      |
| Residential               | 12.3        | 13.0        | 13.6        | 13.2        | 13.7        | 13.9        | 2.4%                 |
| Commercial                | 8.4         | 8.4         | 8.8         | 9.0         | 9.2         | 9.5         | 2.6%                 |
| Industrial (ex NUGs)      | 17.3        | 17.4        | 17.0        | 13.4        | 14.0        | 14.3        | -3.8%                |
| Non-Utility Generators    | 6.5         | 7.2         | 9.0         | 11.1        | 13.0        | 15.1        | 18.4%                |
| Electric Utilities        | 8.9         | 8.5         | 8.3         | 7.4         | 7.1         | 7.1         | -4.4%                |
| Lease & Plant Use         | 3.2         | 3.1         | 3.1         | 3.2         | 3.2         | 3.2         | 0.0%                 |
| Pipeline Fuel             | 1.8         | 1.8         | 1.7         | 1.7         | 1.7         | 1.7         | -1.0%                |
| <b>Total Demand</b>       | <b>58.3</b> | <b>59.5</b> | <b>61.5</b> | <b>58.9</b> | <b>61.9</b> | <b>64.6</b> | 2.1%                 |
| Year/Year % Change        | -1.6%       | 0.7%        | 3.4%        | -4.2%       | 5.0%        | 4.4%        |                      |
| <b>Dry Gas Production</b> | <b>51.2</b> | <b>51.1</b> | <b>51.9</b> | <b>52.9</b> | <b>51.6</b> | <b>52.3</b> | 0.4%                 |
| Year/Year % Change        | -1%         | -0.2%       | 1.4%        | 2.0%        | -2.4%       | 1.3%        |                      |
| Net Change in Storage     | 1.4         | -0.5        | -2.3        | 3.1         | 0.2         | -1.0        |                      |
| <b>IMPORTS</b>            | <b>8.6</b>  | <b>9.8</b>  | <b>10.3</b> | <b>10.9</b> | <b>11.5</b> | <b>12.4</b> | 7.6%                 |

Source: US DOE/EIA: Natural Gas Monthly, Short Term Energy Outlook; Deutsche Bank estimates 27-Feb-2002



# New Baseload Electric Plant Costs

...long run with \$3.20 gas and \$1.20/mmBtu coal



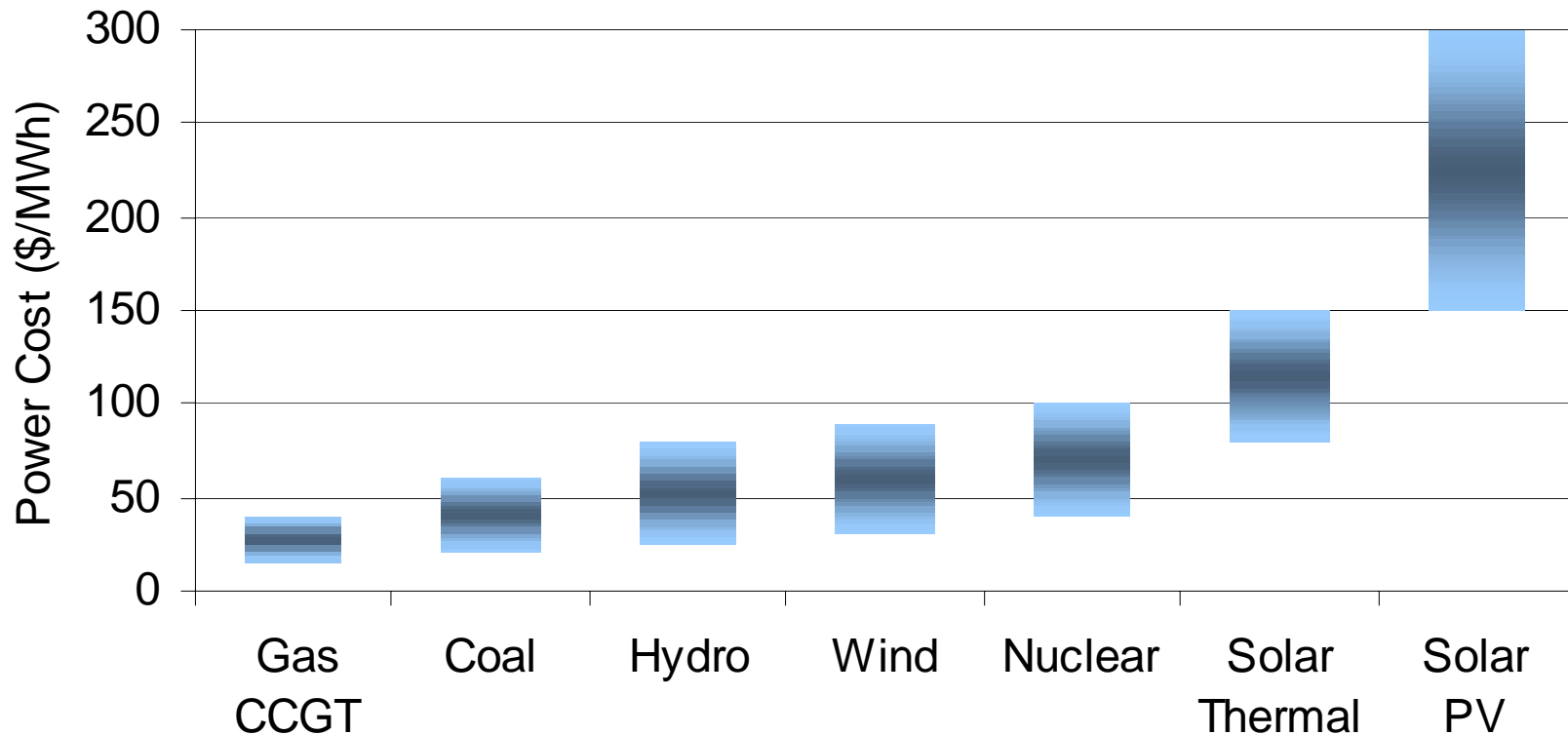
Source: Deutsche Bank estimates





## More New Baseload Electric Plant Costs

...combined cycle gas technology is still the preferred choice



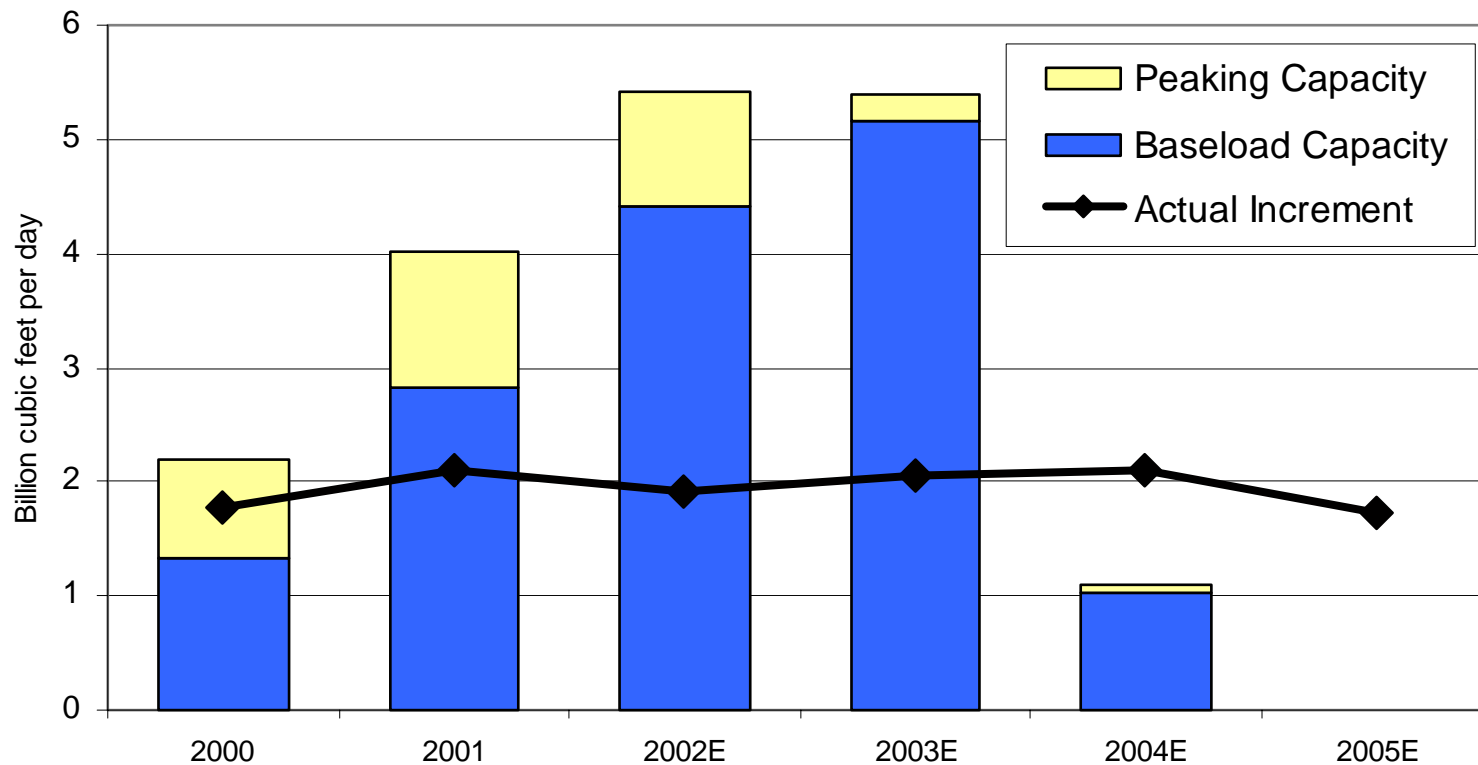
Source: ExxonMobil; Deutsche Bank



# Incremental Natural Gas Demand for Electricity Generation

...huge growth in capacity for gas non-utility generation

...but not all of it shows up as consumption

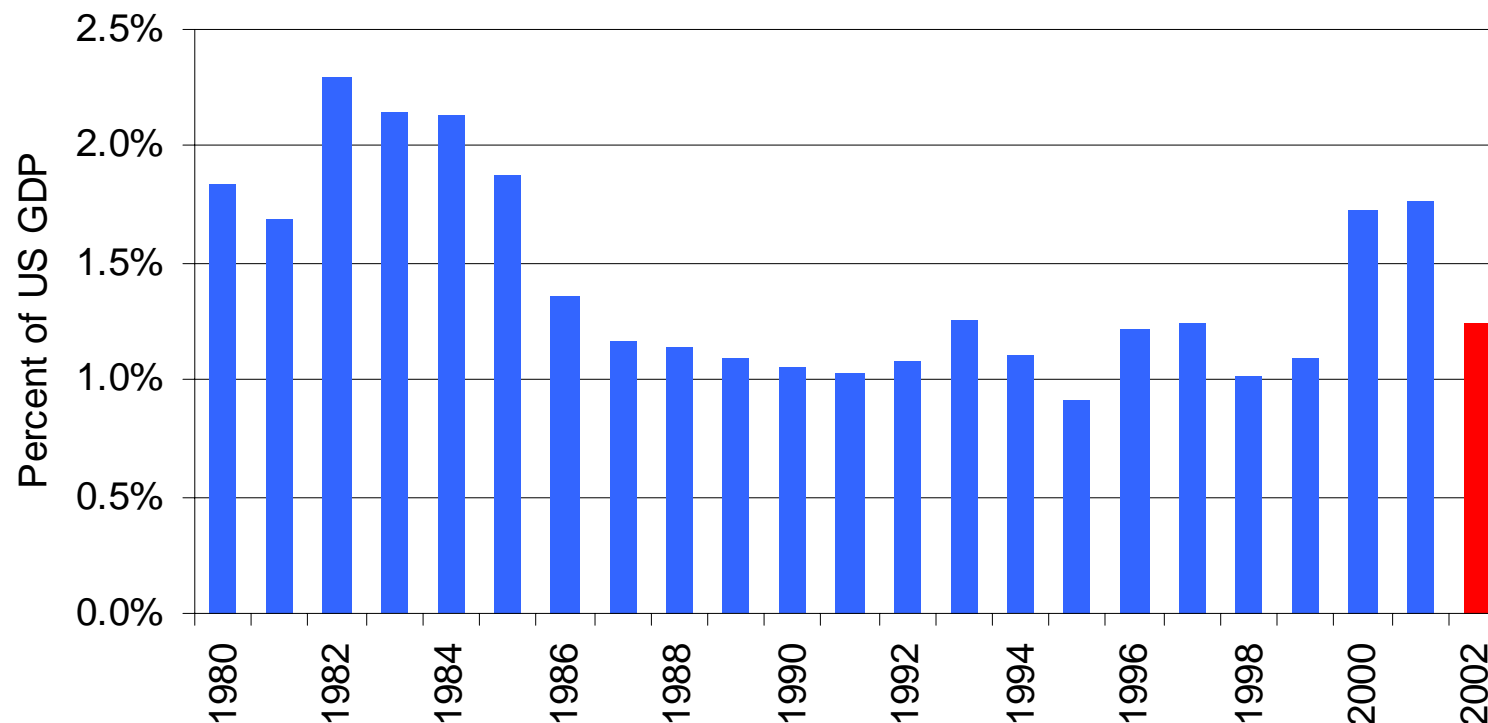


Source: RDI Consulting, Deutsche Bank estimates



## Value of Natural Gas as a Percent of GDP

...importance jumped in 2000-01-- settling back down?

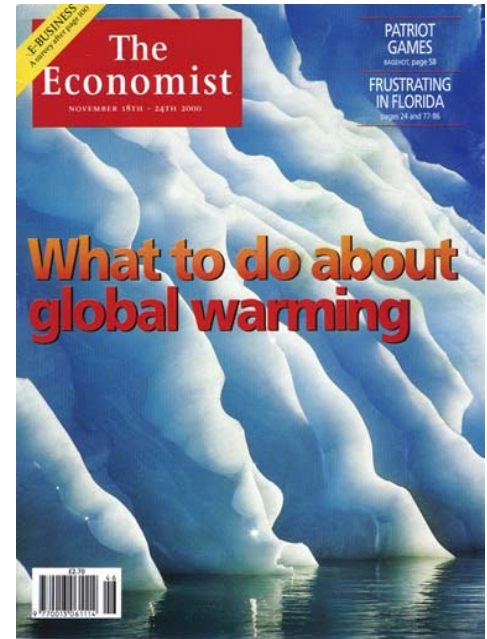
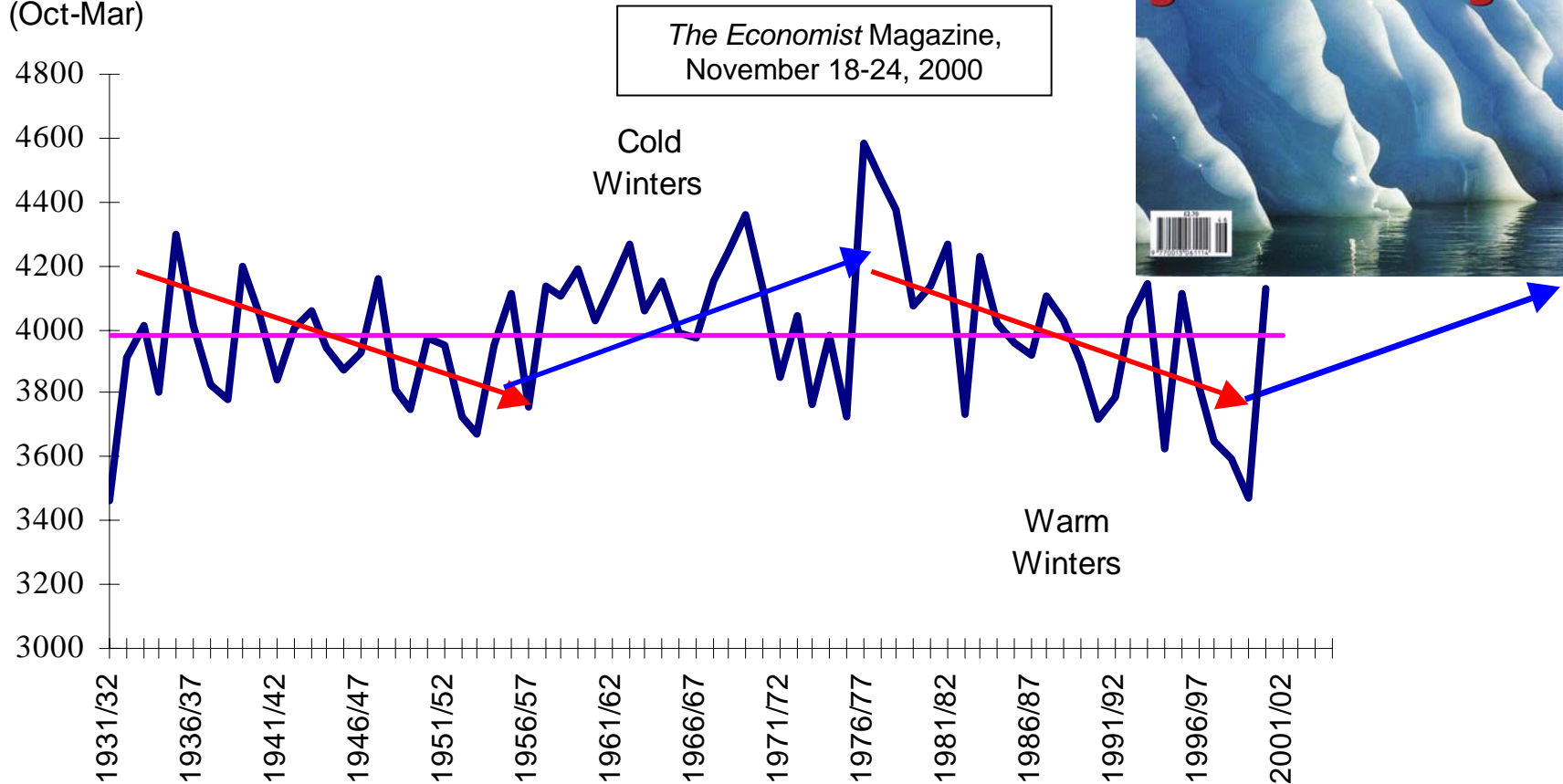


Source: US EIA/DOE and Deutsche Bank estimates



# A Recent Warm Winter Trend? ...followed by a reversion to cold?

US Heating Degree Days  
(Oct-Mar)

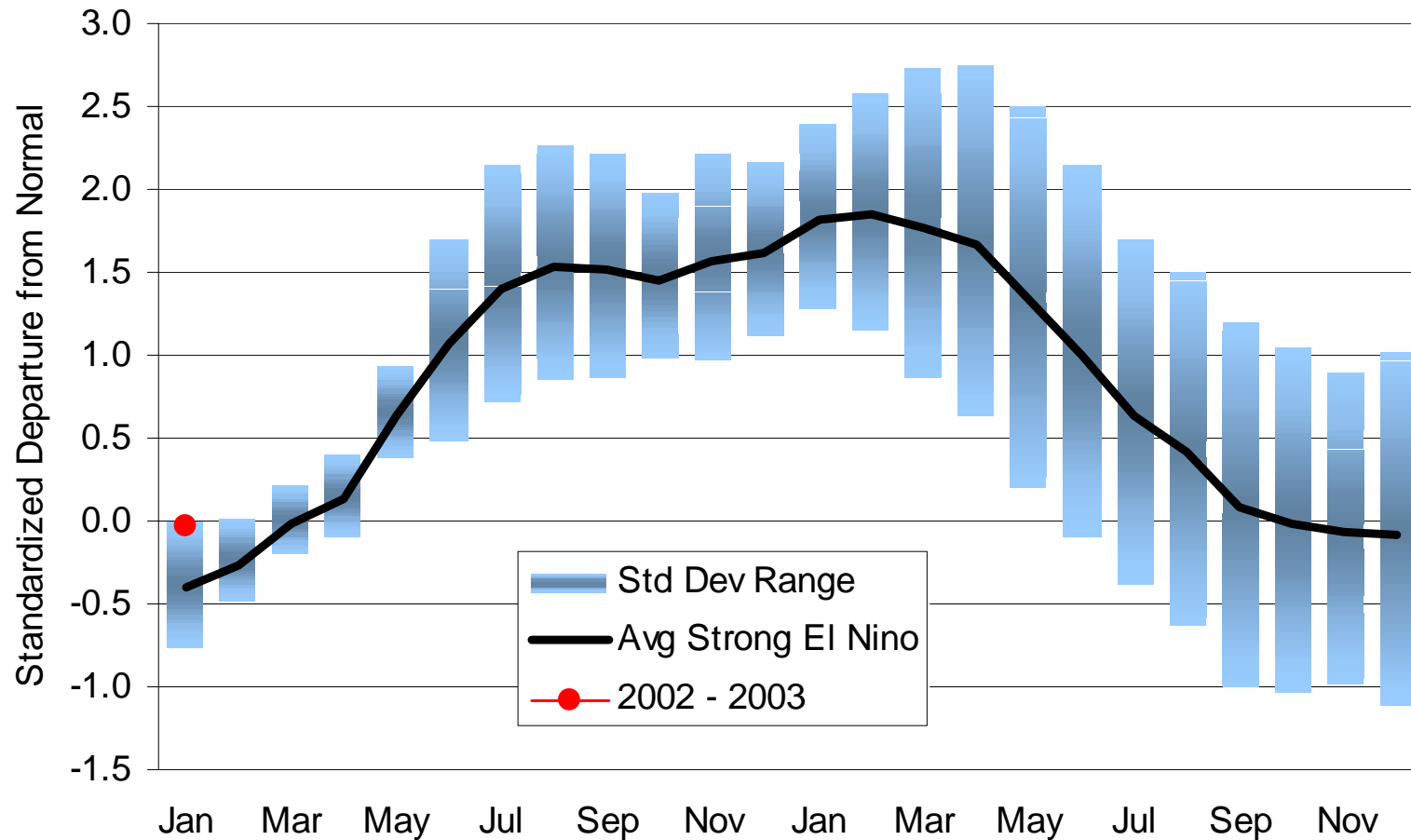


Source: NCDC, Deutsche Bank estimates



# ENSO Index for the Seven Strongest El Ninos

...often brings warm winters and cool summers

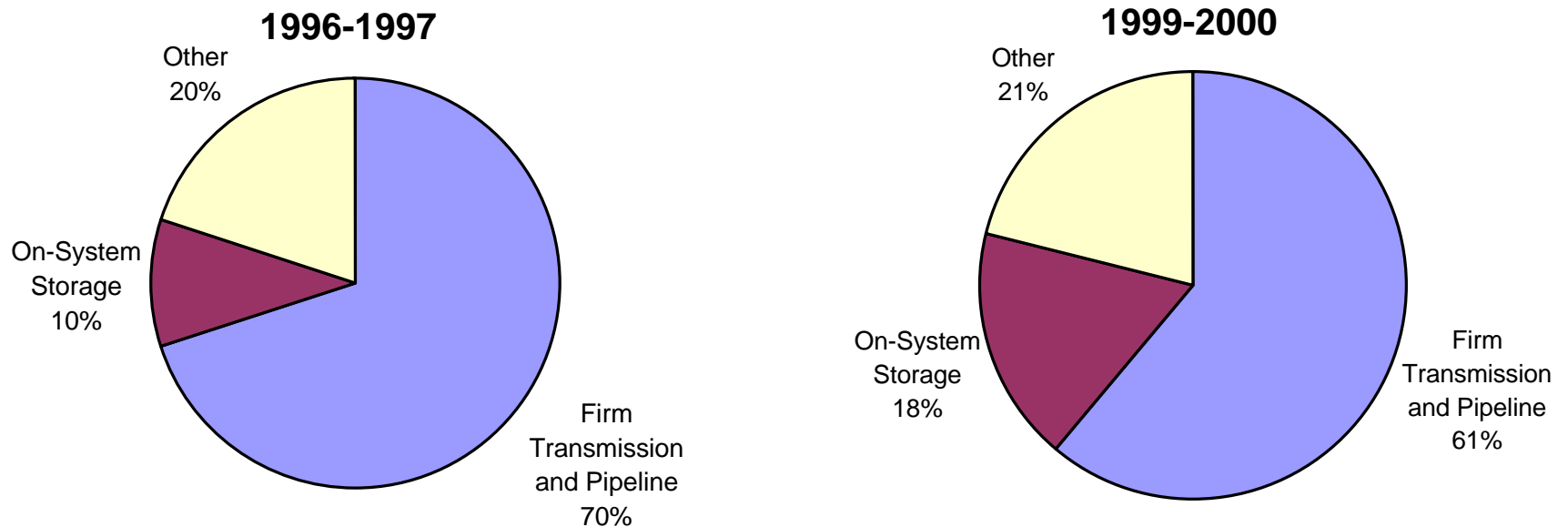


Source: NOAA-CIRES CDC, Deutsche Bank



# Sources for Gas Distribution at Peak Demand

...price volatility increases as firm contracts decline  
and dependence on storage rises

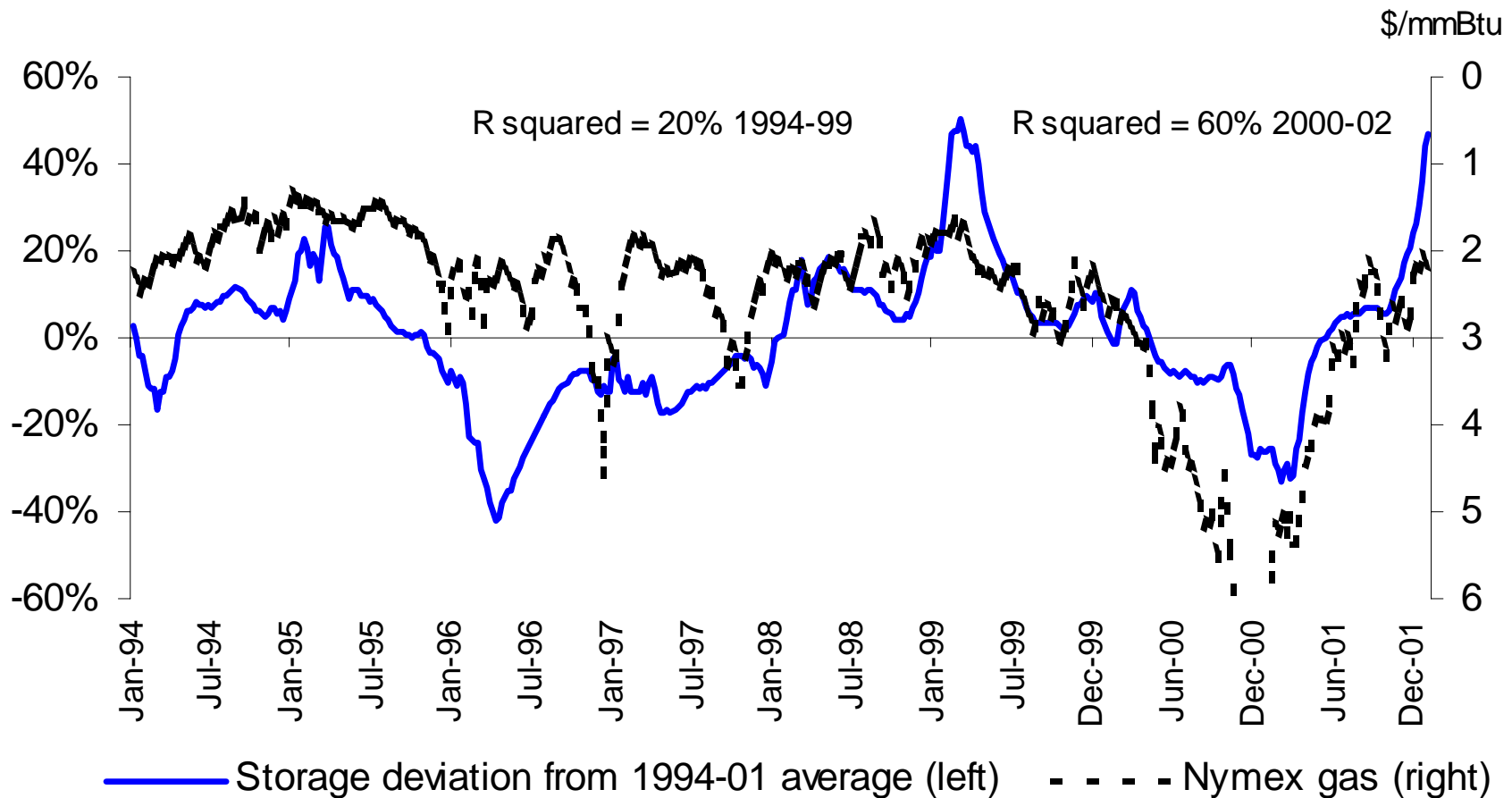


Source: American Gas Association



# Natural Gas Inventories vs Prices

...prices increasingly determined by storage  
due to lower surplus production

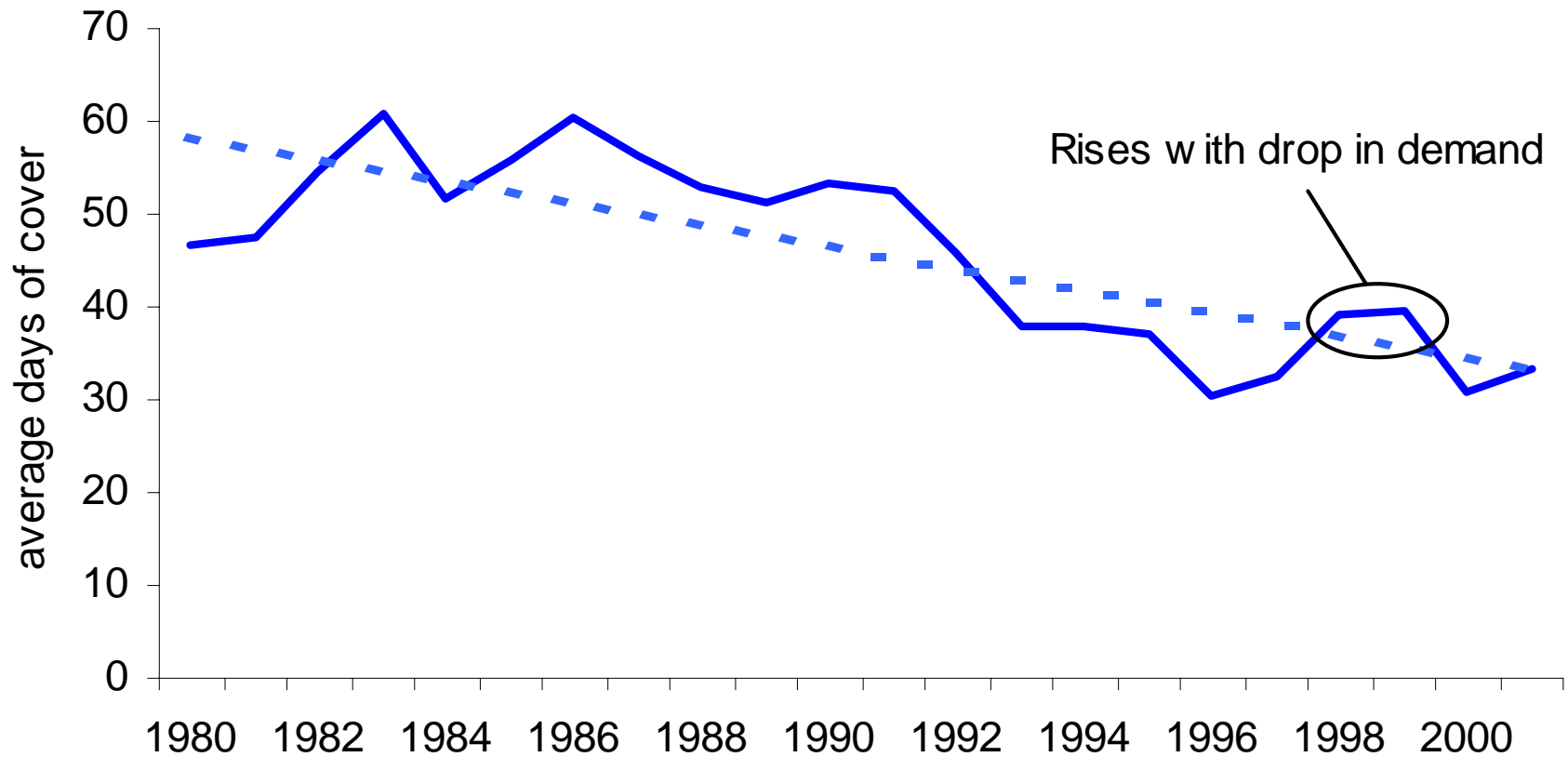


Source: AGA, Nymex, Deutsche Bank estimates



# Natural Gas Inventory Cover of Demand

...the trend since 1983 has been down



Source: DOE/EIA, Deutsche Bank

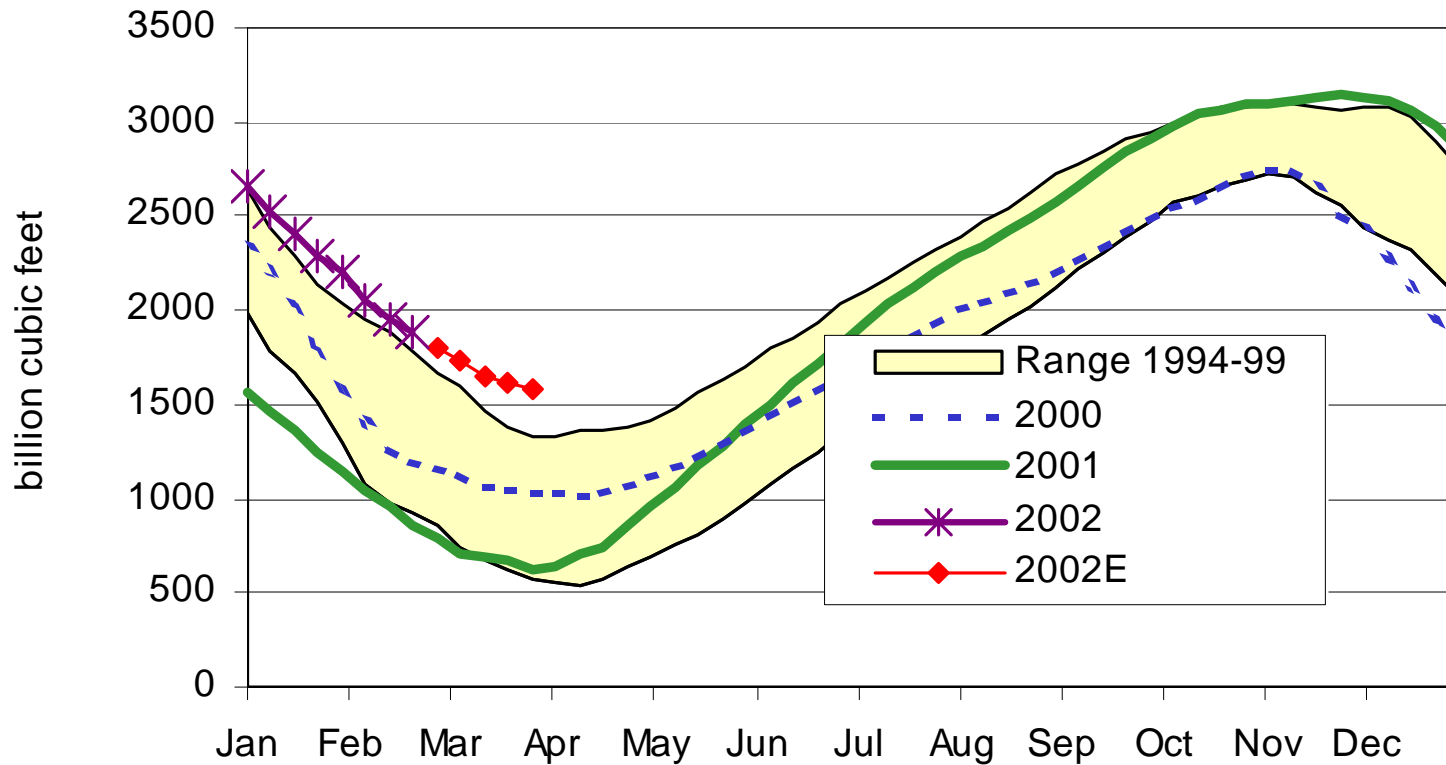




# Total U.S Natural Gas Storage

...warm weather keeping storage full

...uncertainties in NUG and industrial demand



Source: AGA; Deutsche Bank estimates



## Major Factors Driving Natural Gas Demand

...the economy and weather with some price impact

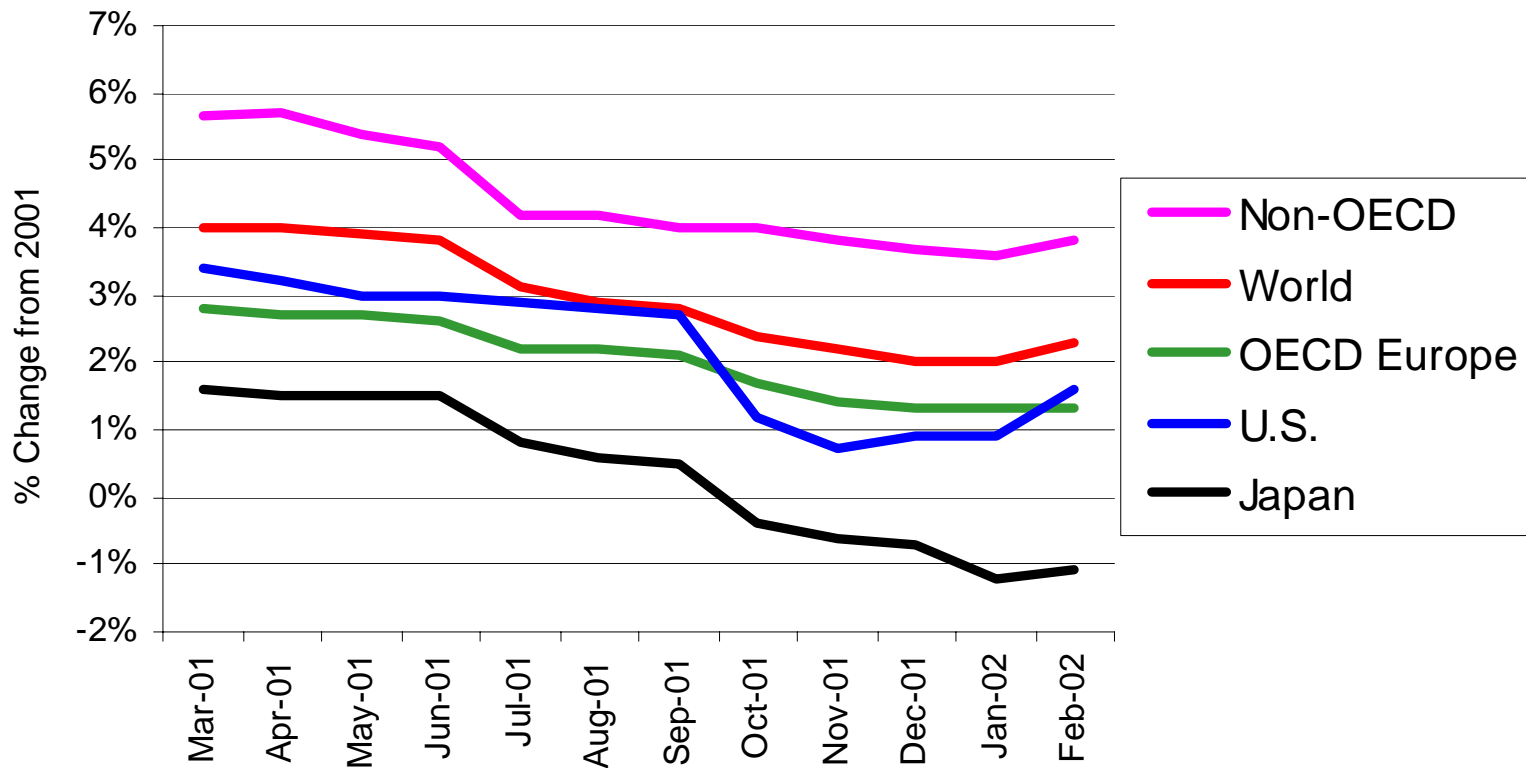
$$\begin{aligned}\% \Delta \text{ Gas Demand} &= 1.0 \times \% \Delta \text{ Real GDP} \\ &+ 0.250 \times \% \Delta \text{ HDD} \\ &+ 0.075 \times \% \Delta \text{ CDD} \\ &+ 0.075 \times \% \Delta \text{ Real Oil Price} \\ &- 0.100 \times \% \Delta \text{ Real Gas Price (lag)} \\ &- 0.300 \text{ (constant)}\end{aligned}$$

Source: Deutsche Bank



# GDP Forecasts Are Volatile

...slowdown presents a major downside risk to demand

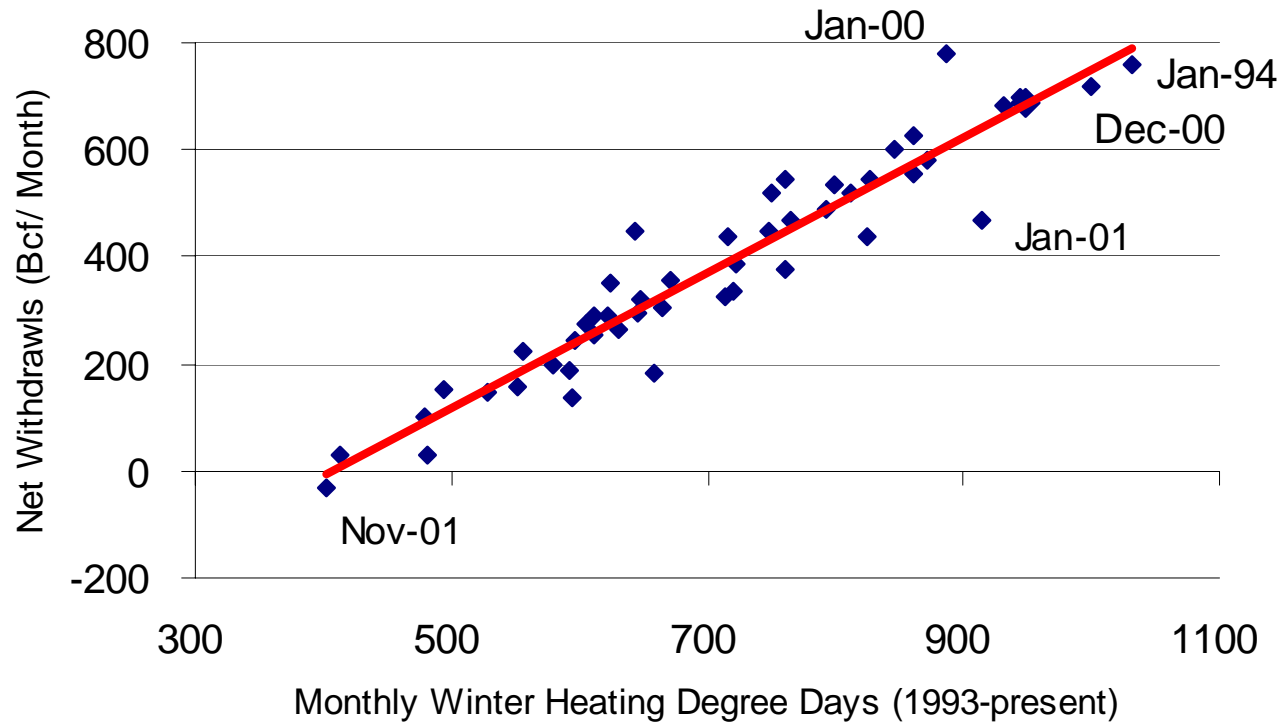


Source: Consensus Economics Inc; IMF; Deutsche Bank estimates



# Gas Storage Net Withdrawals vs. Heating Degree Days

...a month with 800 HDDs  
suggests a 500 bcf net draw from storage

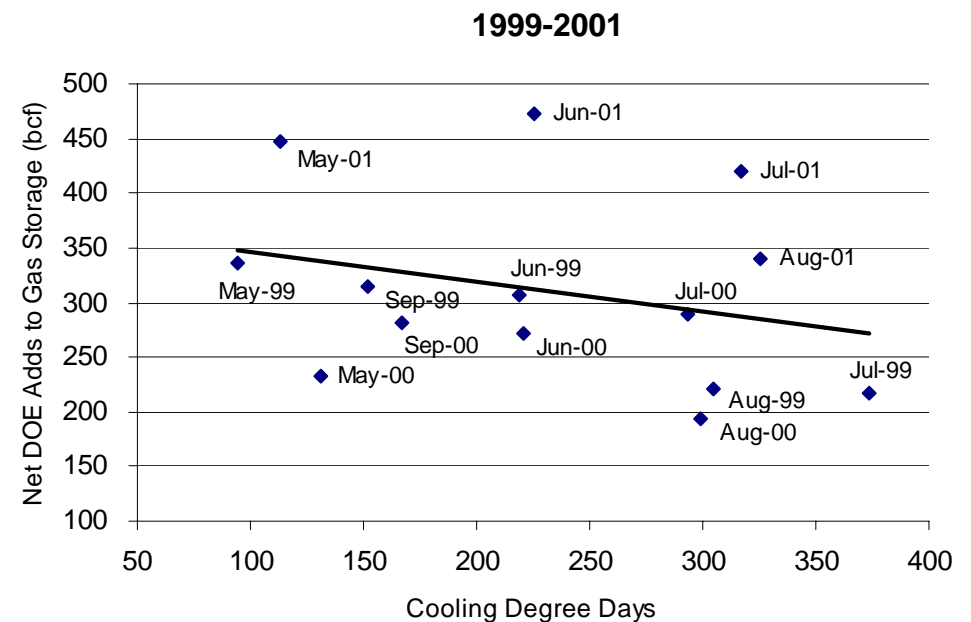
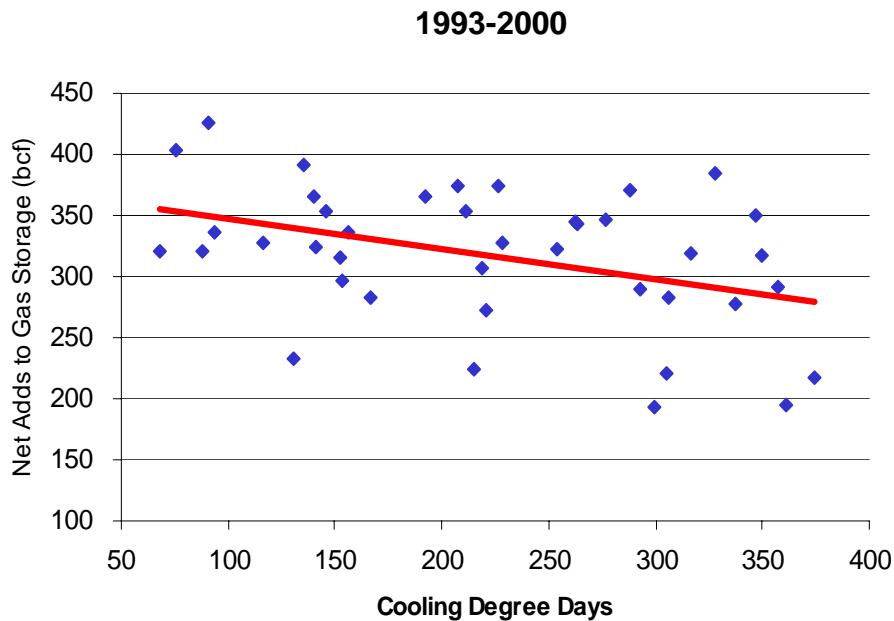


Source: U.S. DOE/EIA; NOAA; Deutsche Bank estimates



# Gas Storage Additions and Cooling Degree Days

...additions slow when the weather is hot  
...and the wide scatter suggests predictability was low  
but CDDs are more important in recent years



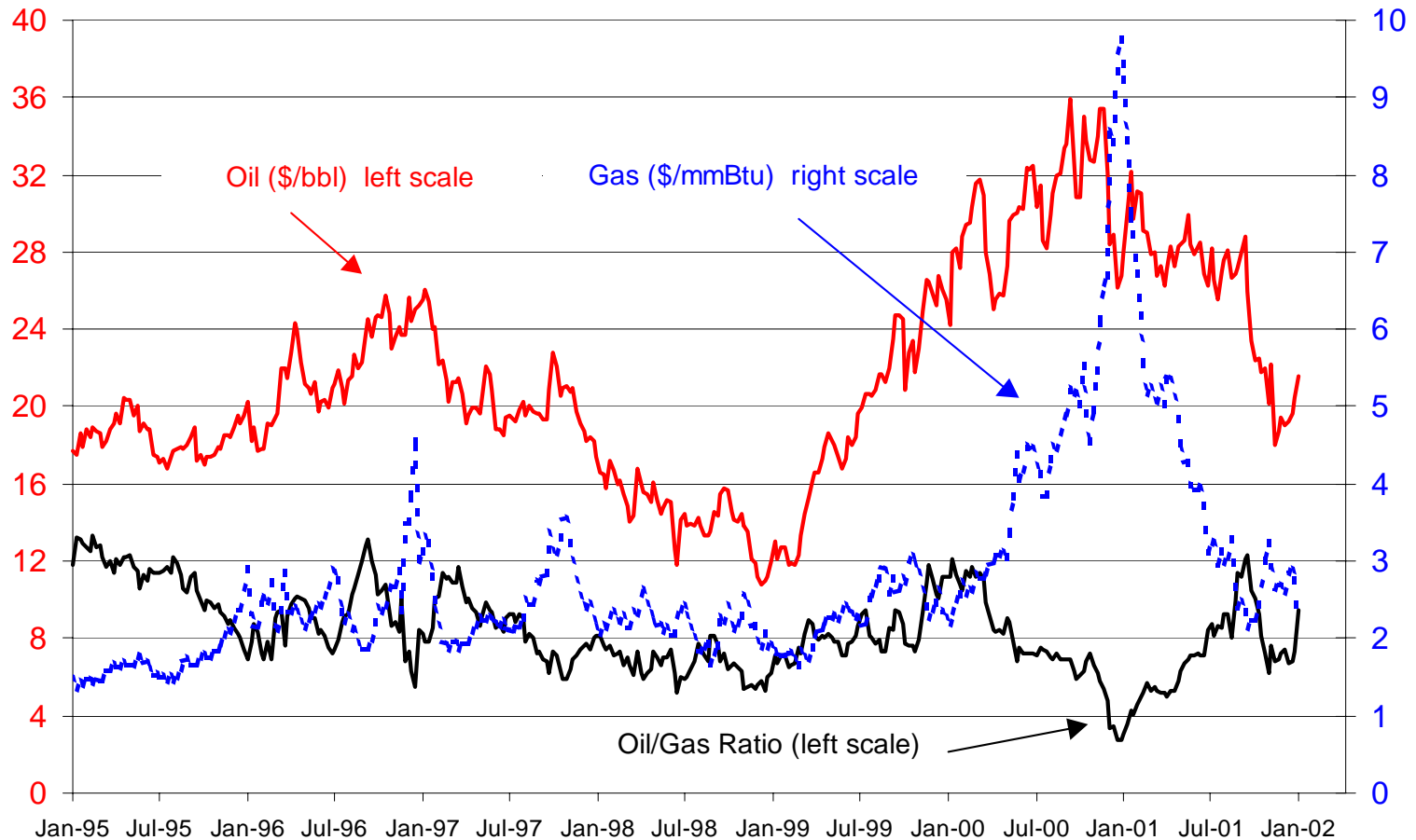
Note: Data covers May-September, 1993-2000

Source: NOAA/NCDC and DOE/EIA



# Natural Gas Prices Are Influenced by Crude Oil Prices

...oil/gas ratio reverts to "normal" level of 8:1

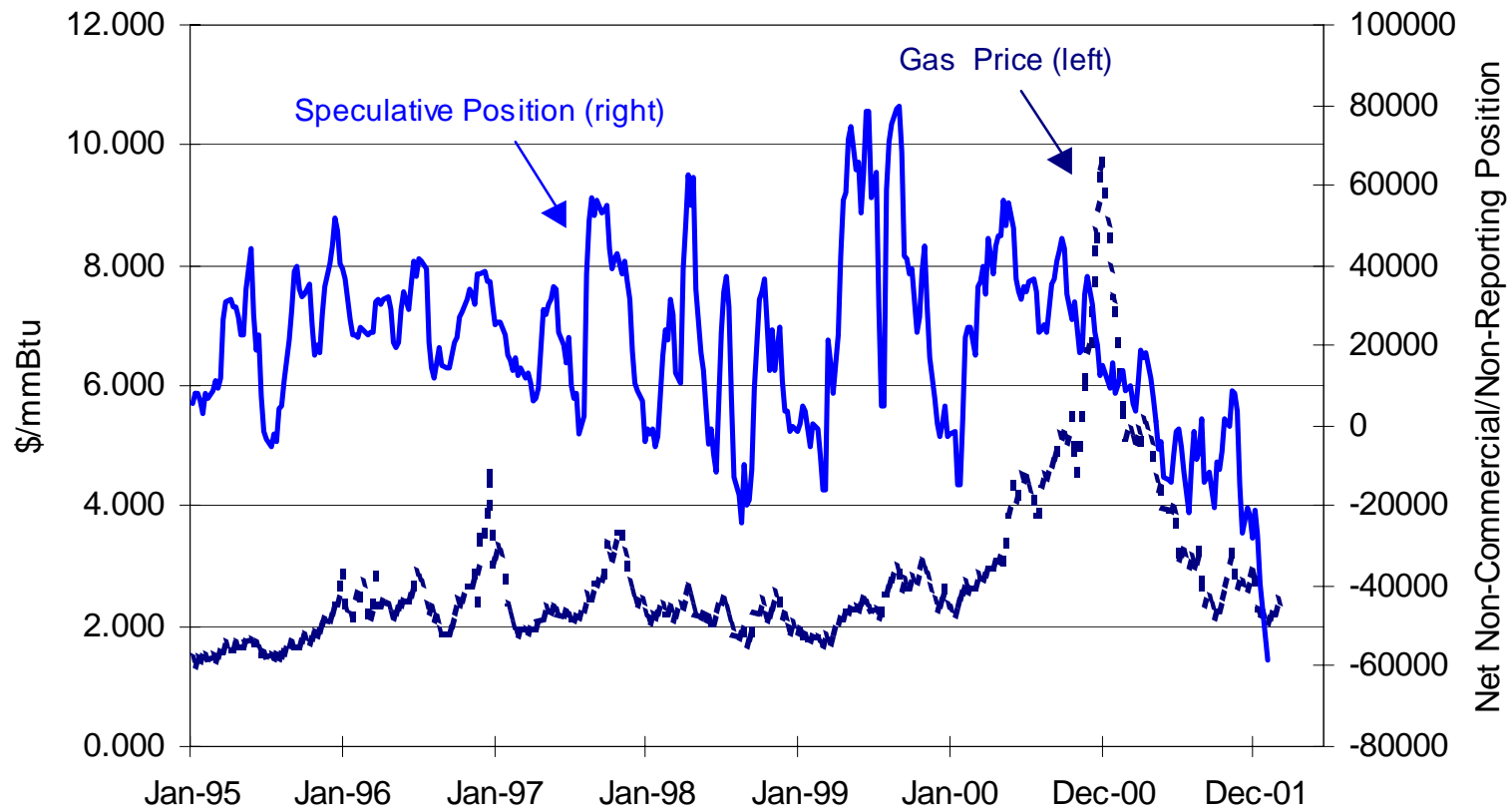


Source: Nymex, Bloomberg



# Speculative Position of Gas Traders

...gas price falling in line with greater speculative selling



Source: Nymex; US CFTC



# Can New Supply Sources Help Offset Volatility?

...long-distance gas, coalbed methane, deepwater

- New LNG terminals
  - West Coast / Baja, Mexico?
  - US GOM?
- Pipelines from the Arctic
  - Alaska gas to Chicago?
  - Mackenzie gas to fuel Alberta tar sands?
- More eastern Canadian gas to New England?
- Coalbed methane?
- Mexican gas to Texas?





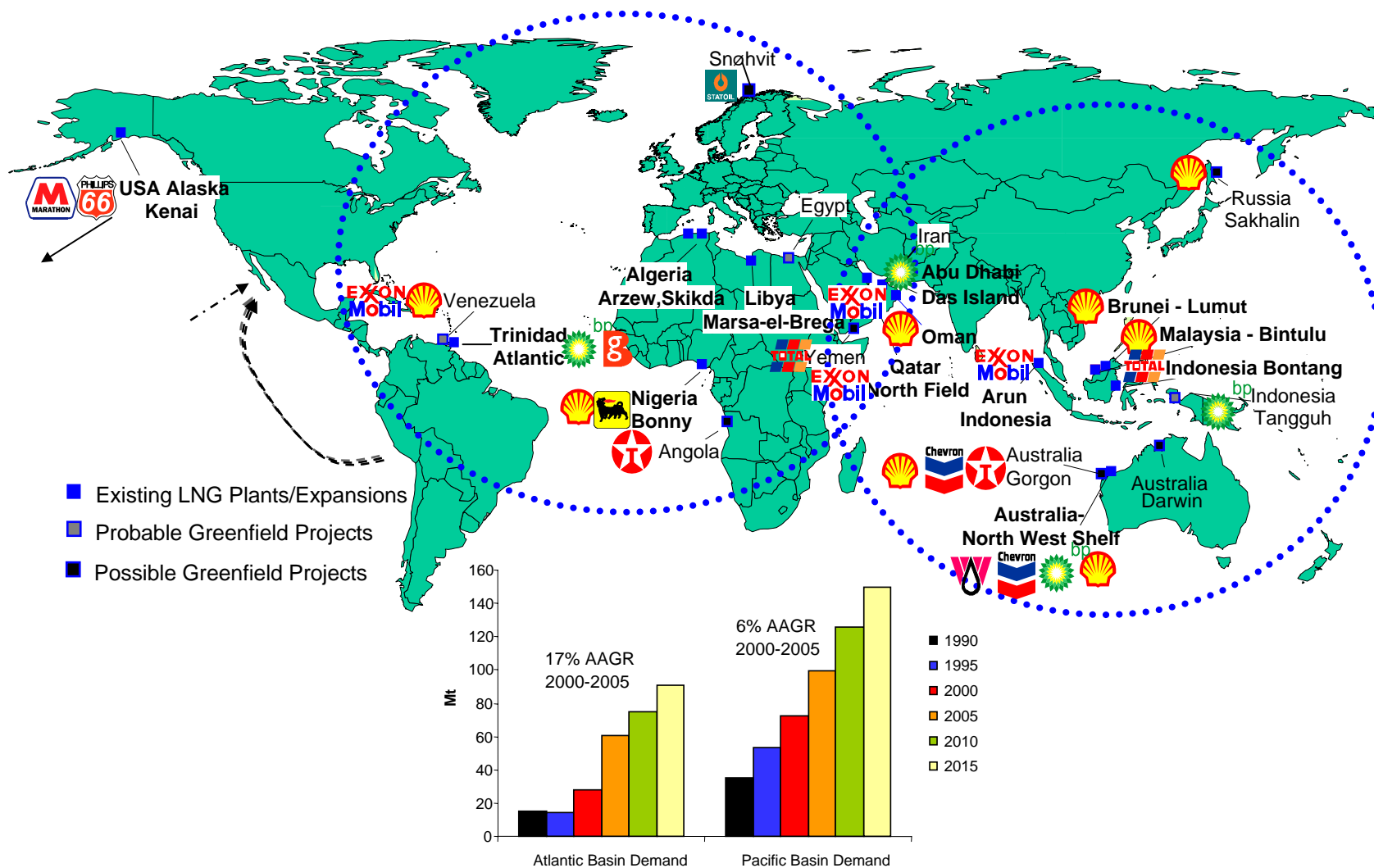
# Potential “Long Distance” Supply Projects into U.S.



Source:  
DOE/IEA;  
Deutsche Bank  
comments



# Where is LNG? Global supply: two regional basins



Source: DB estimates, Company Data, Wood Mackenzie



# Kings of the Wild Frontier

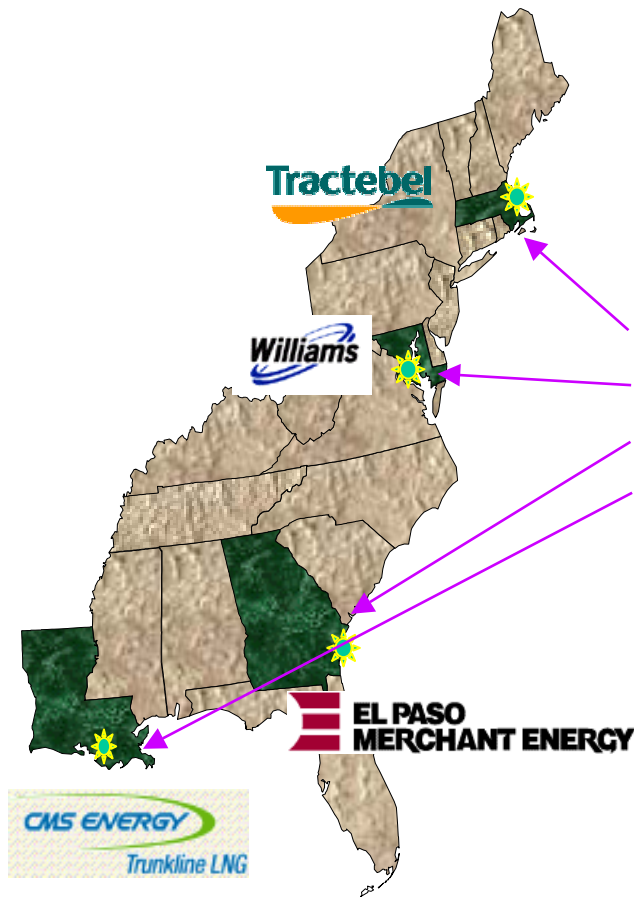
## ...pricing parameters for long distance US gas

**LNG Mix:** At delivered to pipeline cost of \$2.00-\$3.50/mmBtu (with a 15% project return) we estimate that some 1,000 tcf of gas could ultimately access the US as LNG. The project range encompasses the world-class Trinidad (BP, BG, Repsol), Shell-dominated Nigeria (Eni, TOTAL) and US-run Qatar (ExxonMobil). Gas from Libya and Venezuela could also make the hurdle, suggesting a major benefit for the company that resolves the US domestic politics.

**Giant Pipelines:** Current indications for the capital cost of the proposed Alaska gas pipeline (ExxonMobil, BP, Phillips) suggest that it requires a price of at least \$3.80/mmBtu. Without lowering the cost, we doubt that this gas will access Chicago before 2010, despite the extremely low upstream gas cost and huge reserves. However, the returns from Sable Island (Exxon, Shell) are set to rise the longer the gas price remains over its estimated breakeven of \$2.30/mmbtu.



# Capacity of U.S. LNG Regasification Terminals



|                  | Potential Sendout Capacity (bcf/d) | 2001 Storage Capacity (bcf) | Adds (bcf) | Total (bcf) | Timeframe |
|------------------|------------------------------------|-----------------------------|------------|-------------|-----------|
| Everett, MA      | 0.79                               | 3.6                         | 1.8        | 5.4         | 2003      |
| Cove Point, MD   | 0.75                               | 6.8                         | 2.5        | 9.3         | 2002      |
| Elba Island, GA  | 0.54                               | 4.0                         |            | 4.0         | 2002      |
| Lake Charles, LA | 0.70                               | 6.3                         | 2.7        | 9.0         | 2003/4    |
| <b>Total</b>     | <b>2.8</b>                         | <b>20.7</b>                 | <b>7.0</b> | <b>27.7</b> |           |

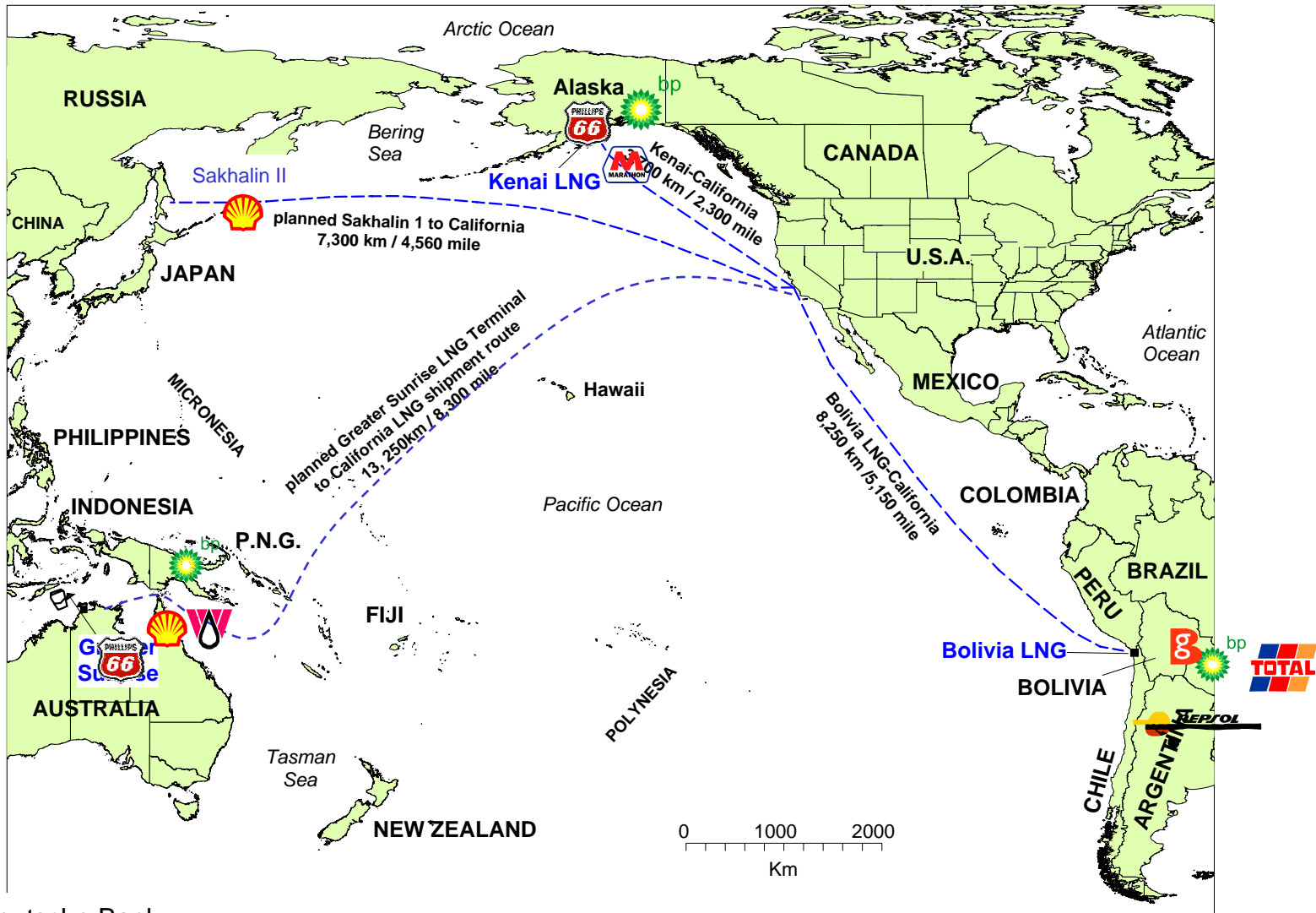
Source: Paso Merchant Energy and Wood Mackenzie Consultants





# West Coast LNG Routes

...longer hauls = higher costs

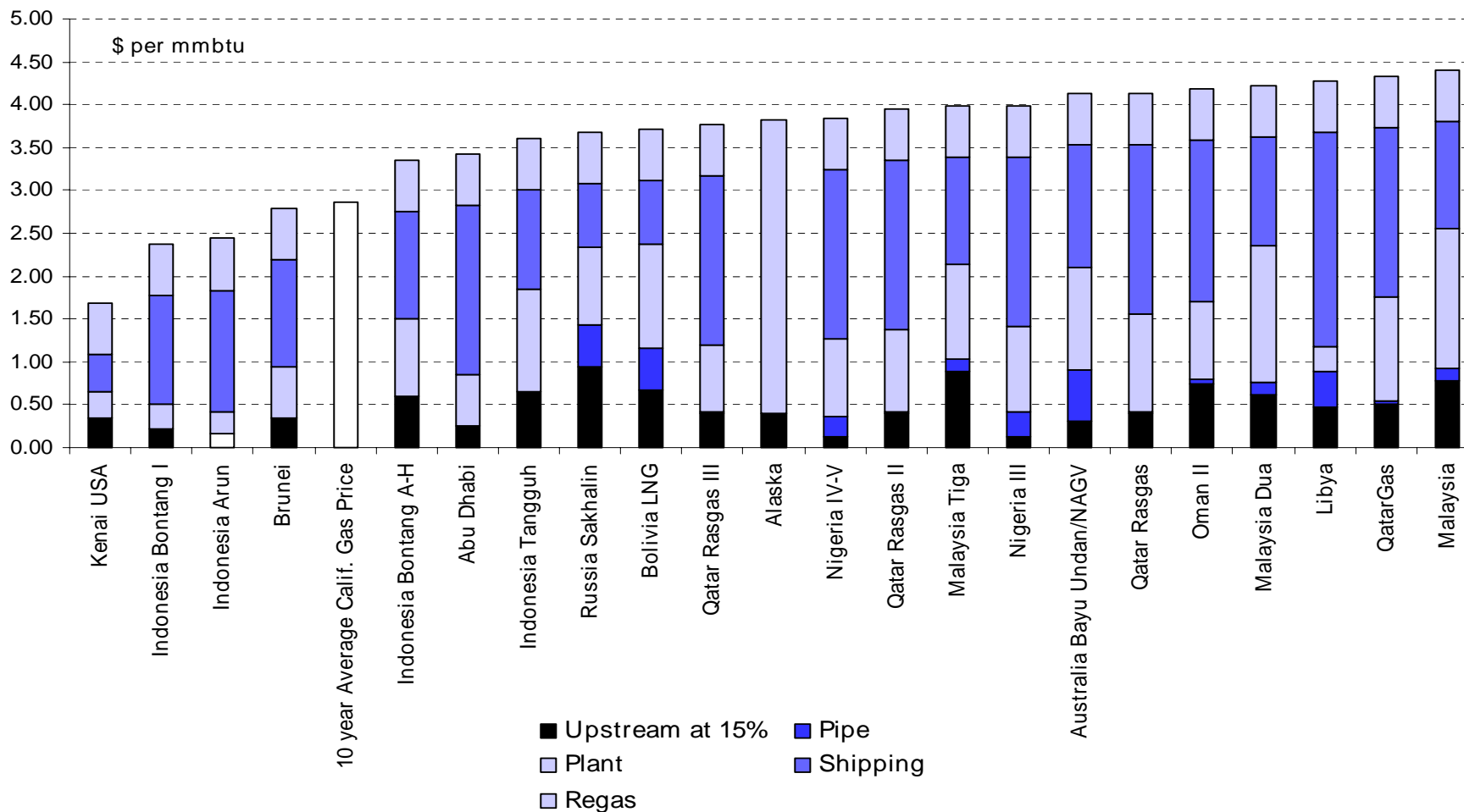


Source: Deutsche Bank



# Delivered LNG Costs to Los Angeles

...plenty of projects for less than \$4/mmBtu

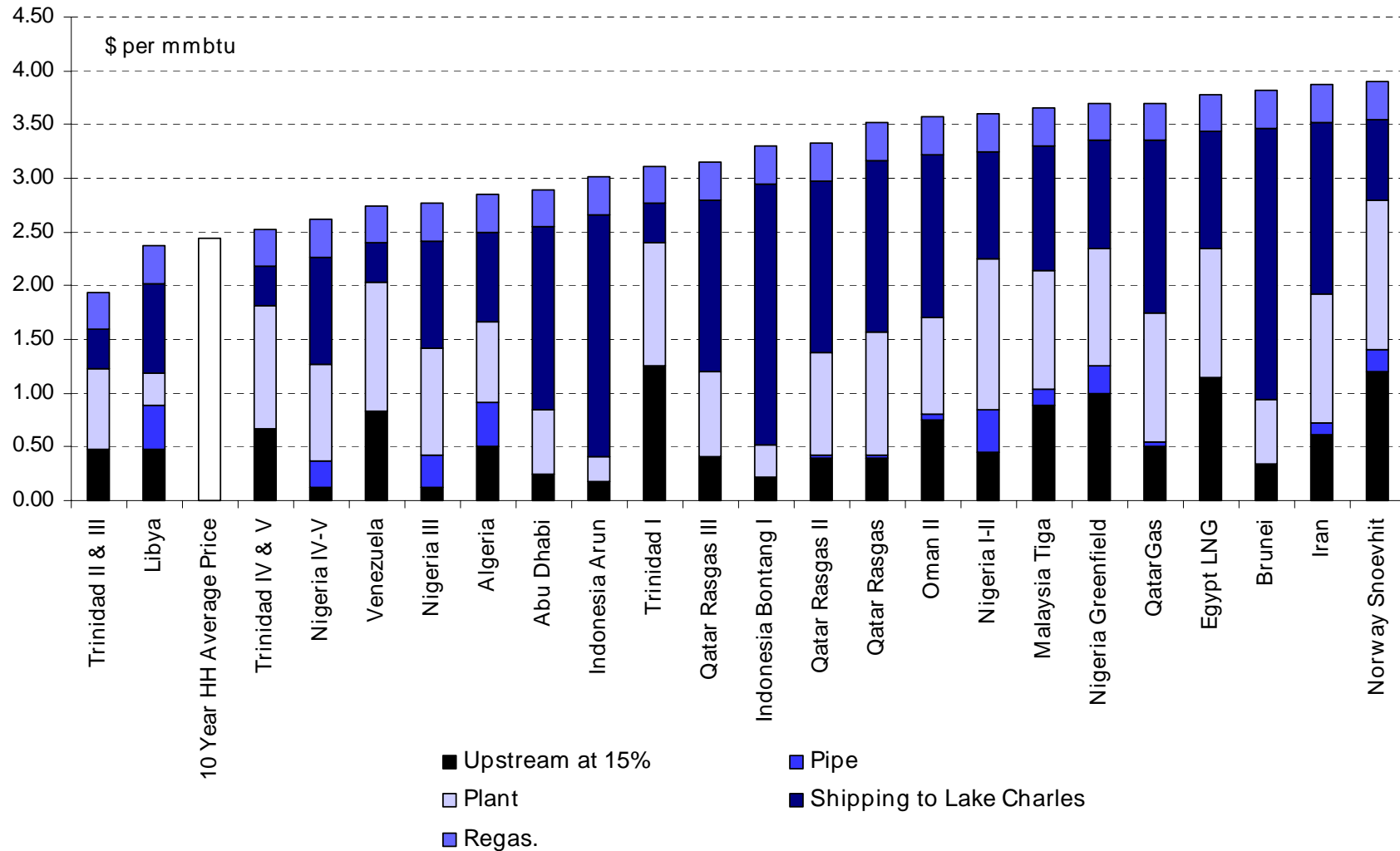


Source: Deutsche Bank estimates



# Delivered LNG Costs to Lake Charles

...plenty of projects for less than \$3.50/mmBtu

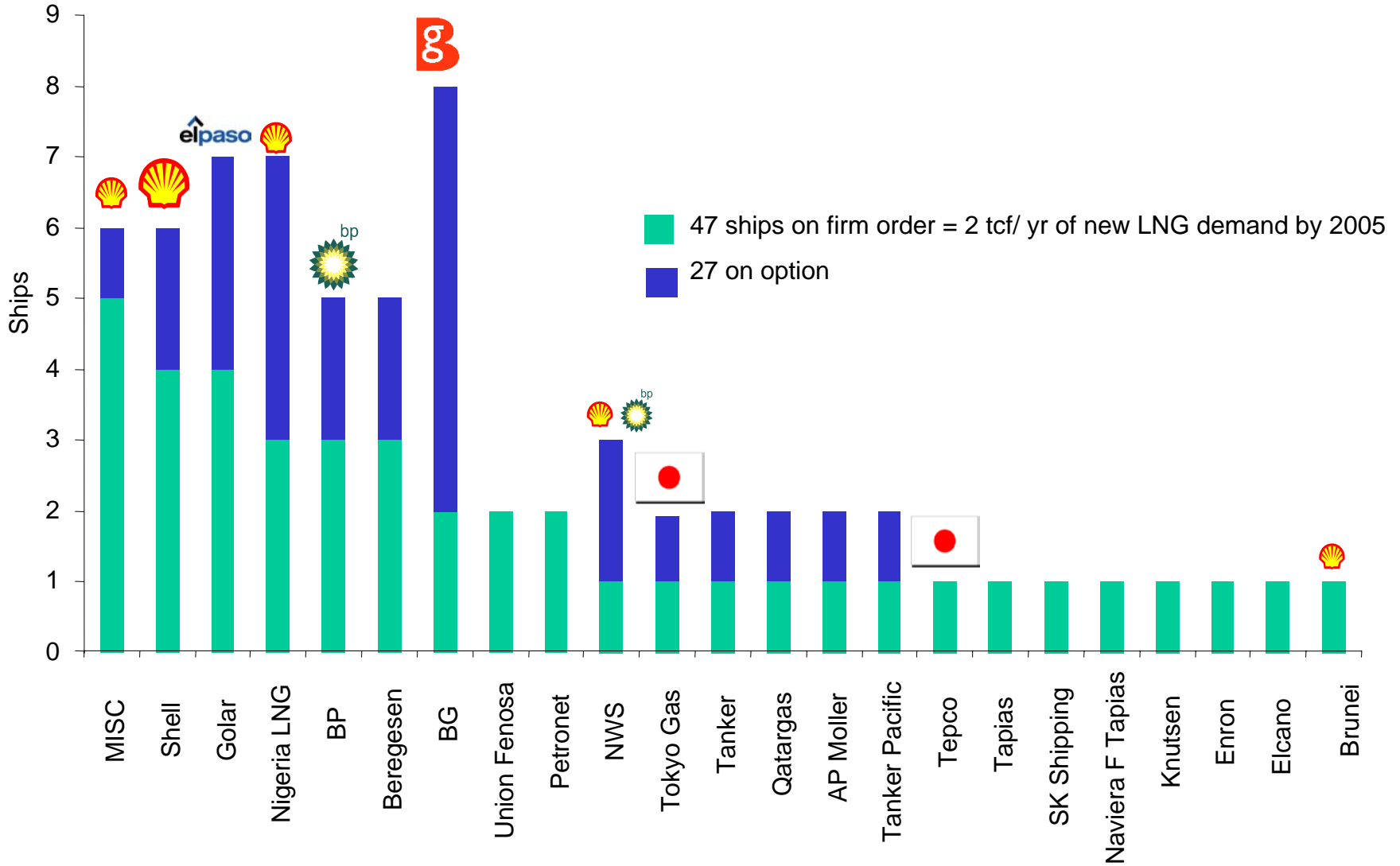


Source: Deutsche Bank estimates





# LNG Tankers on Order or Option

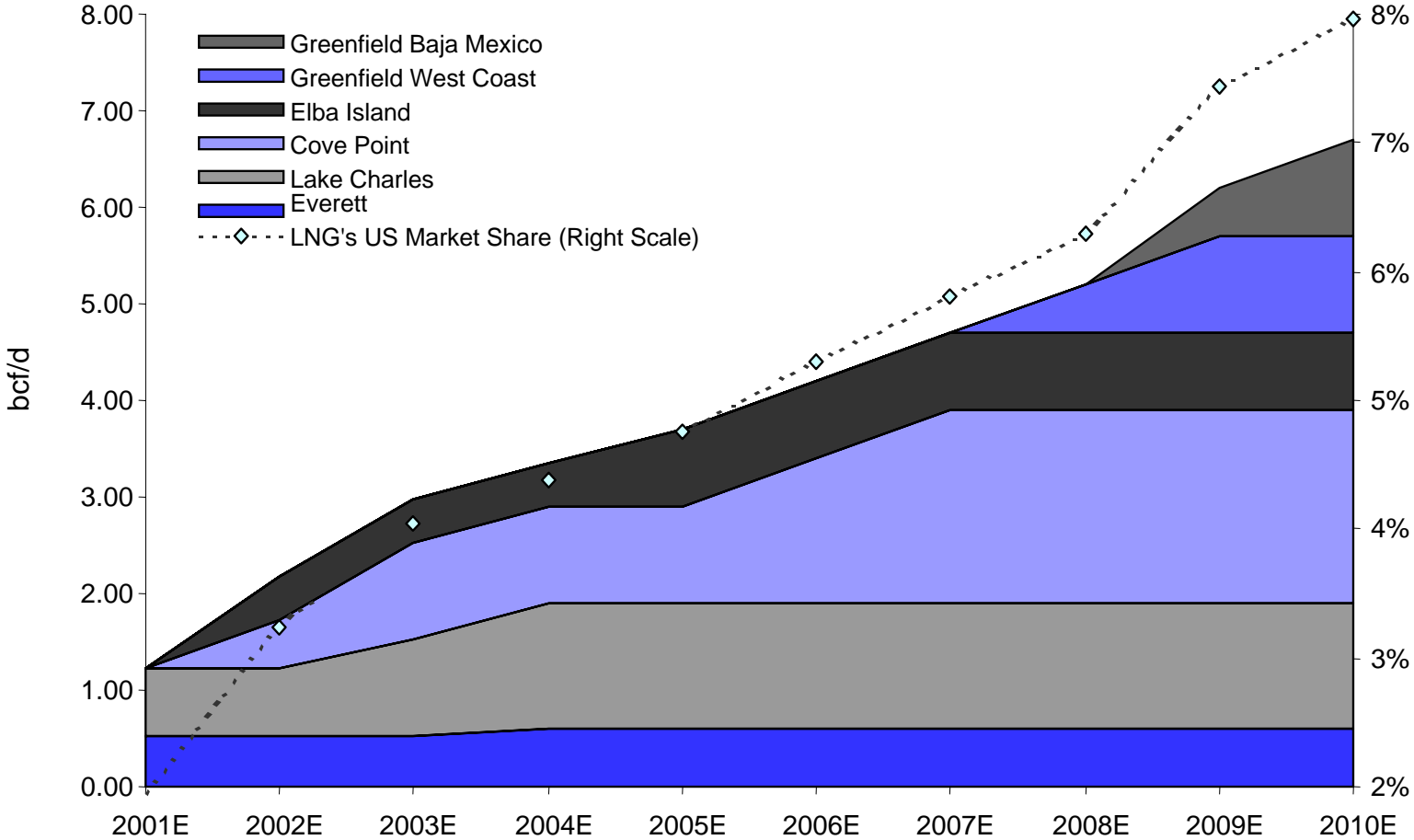


Source: Deutsche Bank estimates



# LNG Constrained by Pace of Regasification Additions

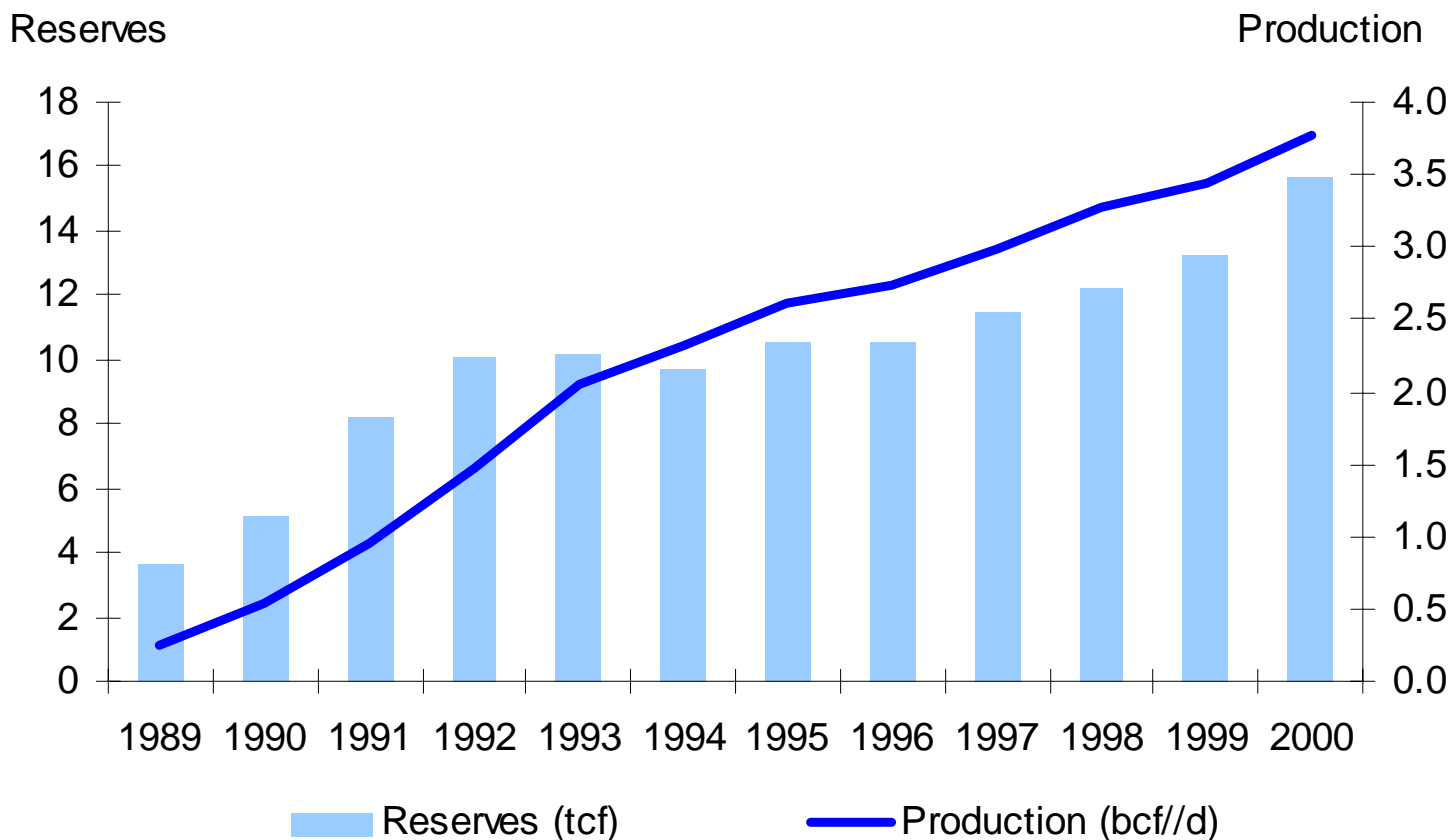
## ...West Coast by 2007-2008?



Source: Deutsche Bank estimates

# Coalbed Methane Reserves and Production

...small but important at the margin

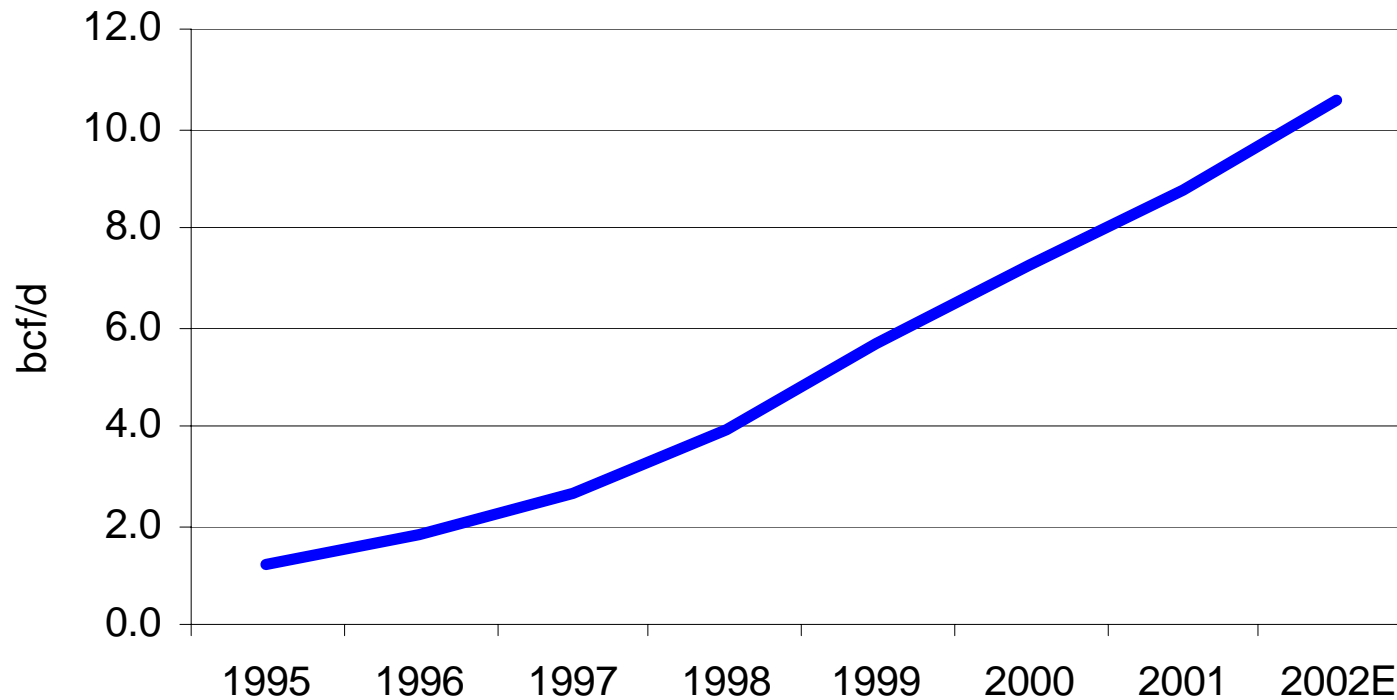


Source: Energy Information Administration, Office of Oil and Gas



# Deepwater Gas Production

...big and continuing to compete effectively with LNG



Source: Wood Mackenzie Consultants



# What Do Energy Investors Really Want?

...volatility might not matter if goals are met

- **Return on Capital** - the ultimate measure of cost and growth performance... more emphasis on the bottom line
- **Quality of Earnings** - consistency & above the cost of capital
- **Sustainable Growth** at low cost - getting the timing right on when to drill, when to deplete, and when to buy
- **Quality of Reserves** and time to first production - Why should investors pay up for long reserves lives or inventories) and long lead times?
- **Disciplined Spending** - only accretive acquisitions.

Source: Deutsche Bank



# What Can Be Done to Offset Price Volatility?

...strategies to reduce risk

- Scale, Integration, Diversification, Liquidity
- Increase operational and contractual flexibility
  - Minimize project lead times
  - Lower costs
  - Fuel switching
- Hedge price risk; Storage to manage volume risk
- Long-term (or levelized) contracts  
(accepting larger credit and business risks)
- Obtain authoritative and credible market information

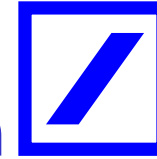
Source: Deutsche Bank



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## ...accurate forecasting is a tough business

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