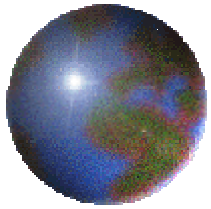


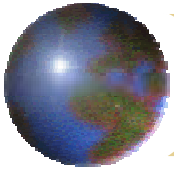
The Outlook for Oil & Gas: Divergence or Chaos?

JULY 2002

MICHAEL C. LYNCH

BUBBLE CHARACTERISTICS

- CERTAINTY THAT IT'S NOT
- ABNORMAL INFLATION
- SOME RESULTS DUE TO FEEDBACK
  - SALES OR DOT.COM PROFITS?
  - INTANGIBLE ASSETS
  - BORROWING FOR MORE STOCK
    - ENRON AND WORLDCOM
      - STUPIDITY AND SELF-DEFEATING



"THE PERFECT STORM"

- RAPID GROWTH RAISES PRESSURE ON ALL COMPANIES
- STOCK OPTIONS INCREASE PRESSURE TO MEET TARGETS
- NEW METHODS OF BUSINESS REDUCE TRANSPARENCY
- BOOM TIMES BRING IN MANY INEXPERIENCED EMPLOYEES

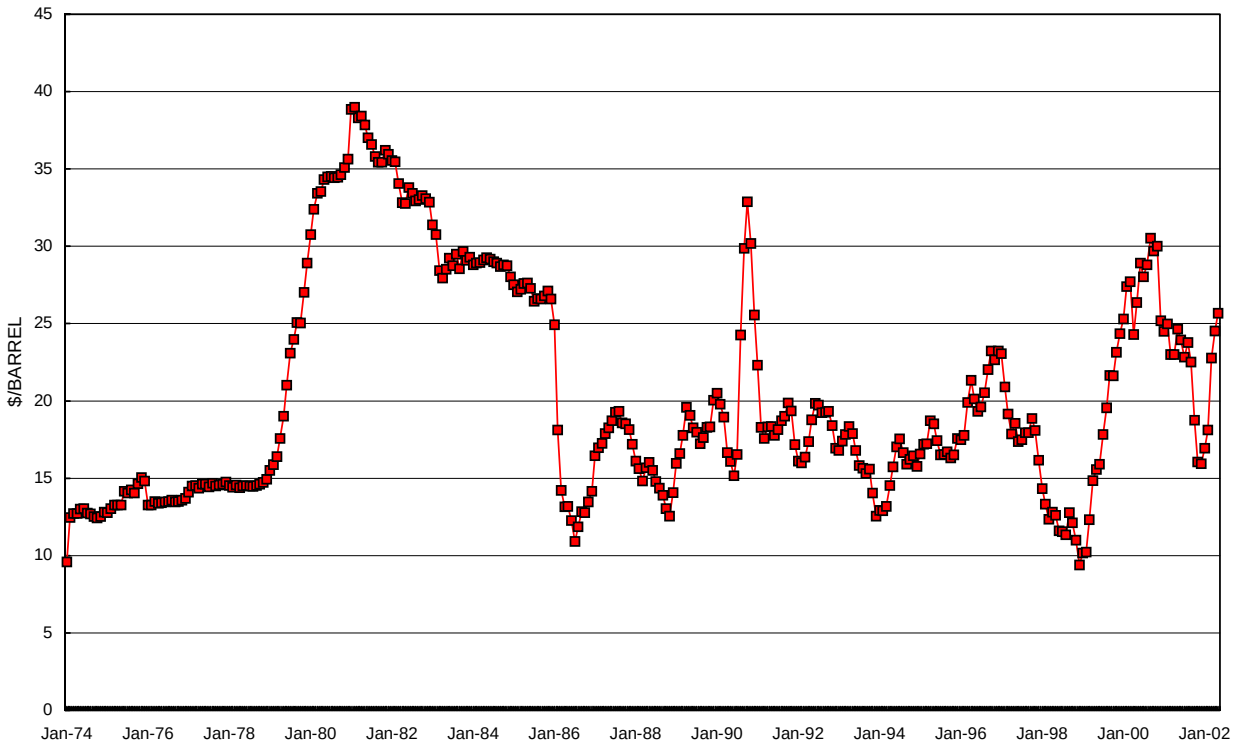
SOURCES OF DISCOMBOBULATION

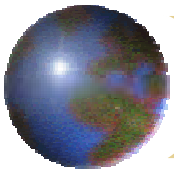
- APRIL 2000: JOINED WEFA, MOVED OFFICE
- FEBRUARY 2001: BOUGHT HOUSE
- MAY 2001: DRI & WEFA MERGED
- OCTOBER 2001: MOVED TO DRI OFFICE
- APRIL 2002: LOST APARTMENT IN BOSTON, MOVED INTO HOUSE
  - COMMUTE BECOMES 3.5 HOURS/DAY DRIVING
- JUNE 2002: LEFT DRI-WEFA, MOVED OFFICE
- FORGIVE THE DISORGANIZATION (GOMEN)

"DÉJÀ VU ALL OVER AGAIN"

- OIL, GAS PRICES SOARING
  - OPEC POWERFUL, AGGRESSIVE
- BLACKOUTS, BROWNOUTS
- GOVERNMENT ROLE IN TRANSITION, UNCERTAIN
  - CALIFORNIA
  - VENEZUELA

US PRICE FOR IMPORTED OIL



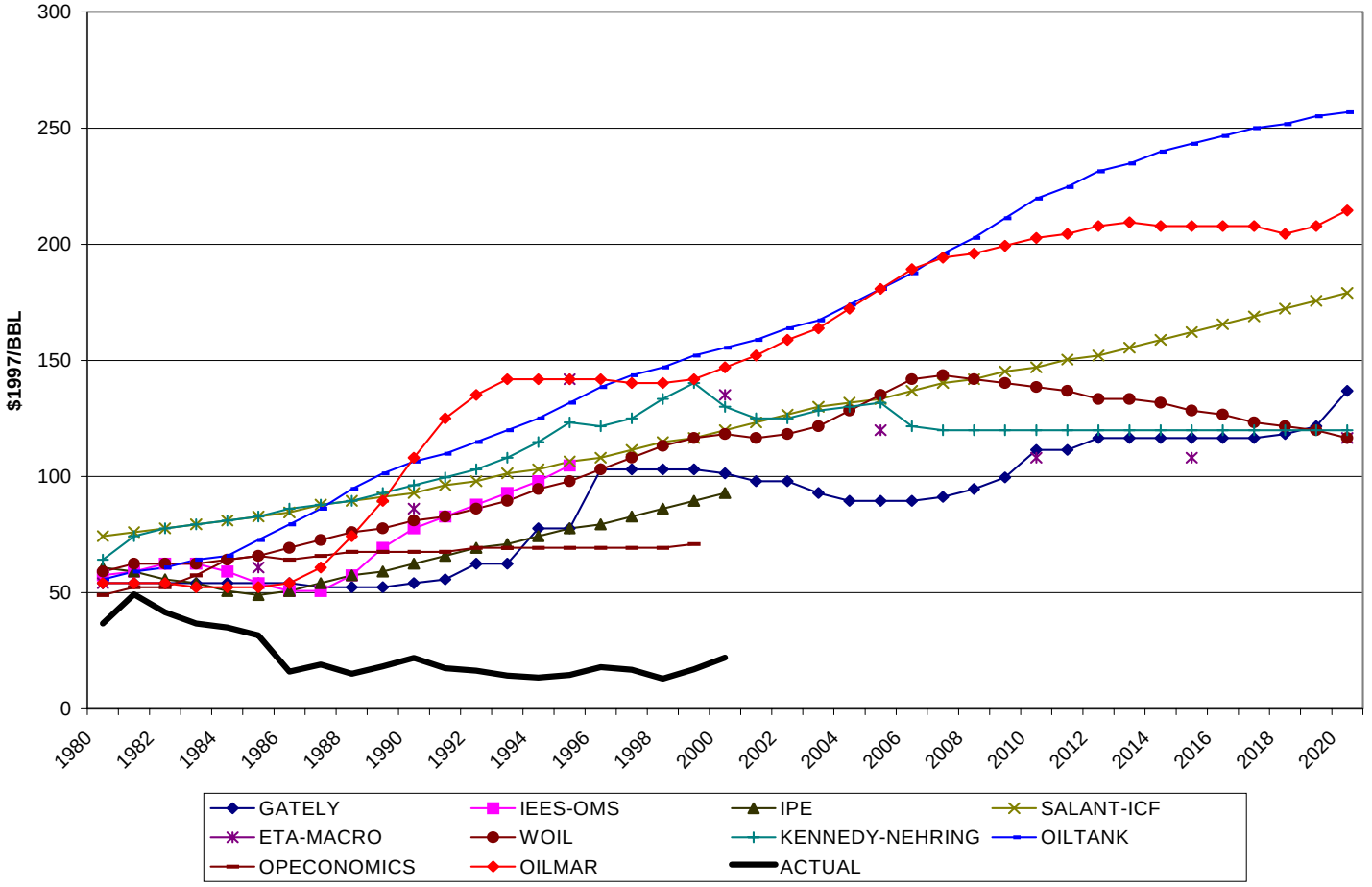


LESSONS OF THE PAST

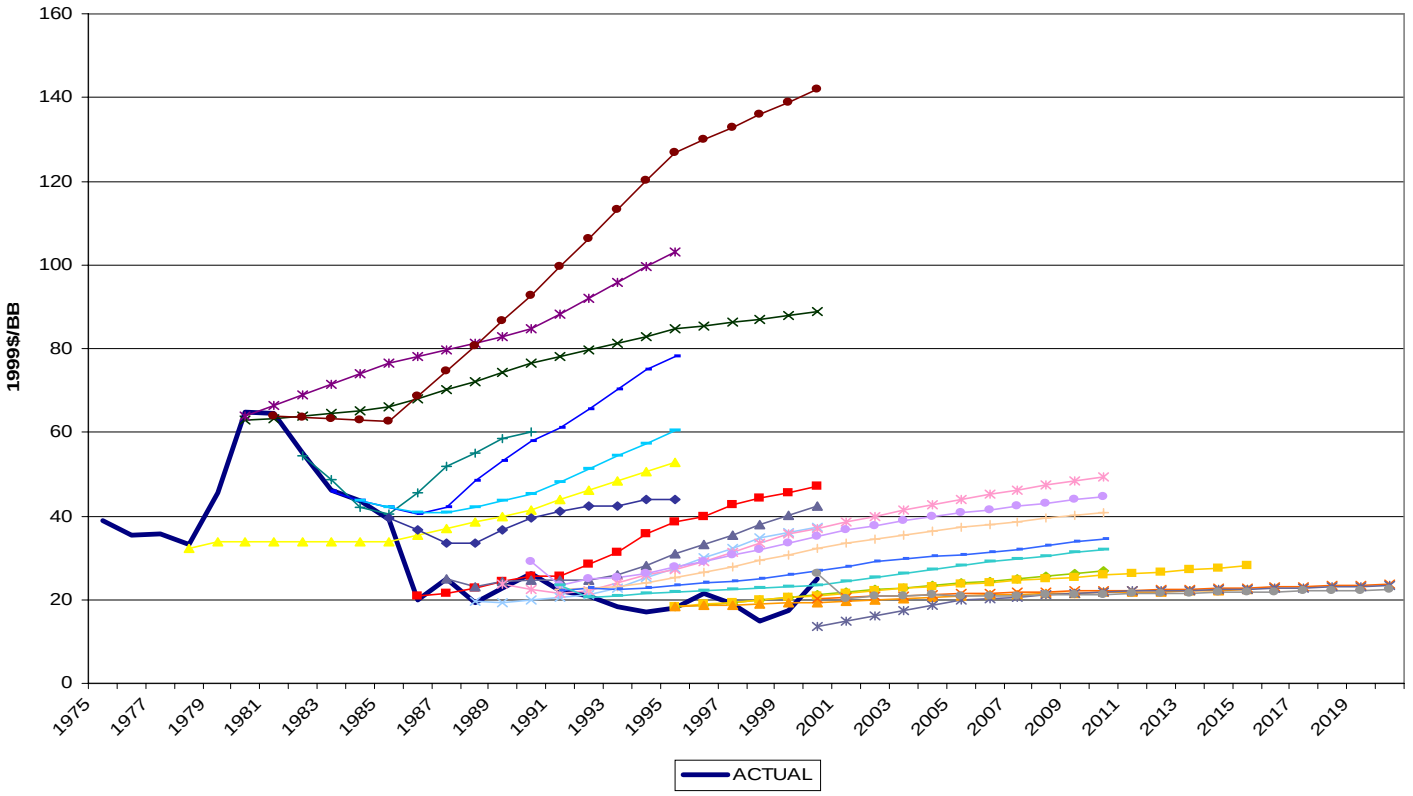
- CONSENSUS VERY BAD
- FORECASTS SUFFERED FROM MALTHUSIAN BIAS, RECURRING ERRORS
- FORECASTERS SLOW TO CORRECT
- SIMPLISTIC RULES SUBSTITUTED FOR IN-DEPTH ANALYSIS

EMF6 Oil Price Forecasts (1980)

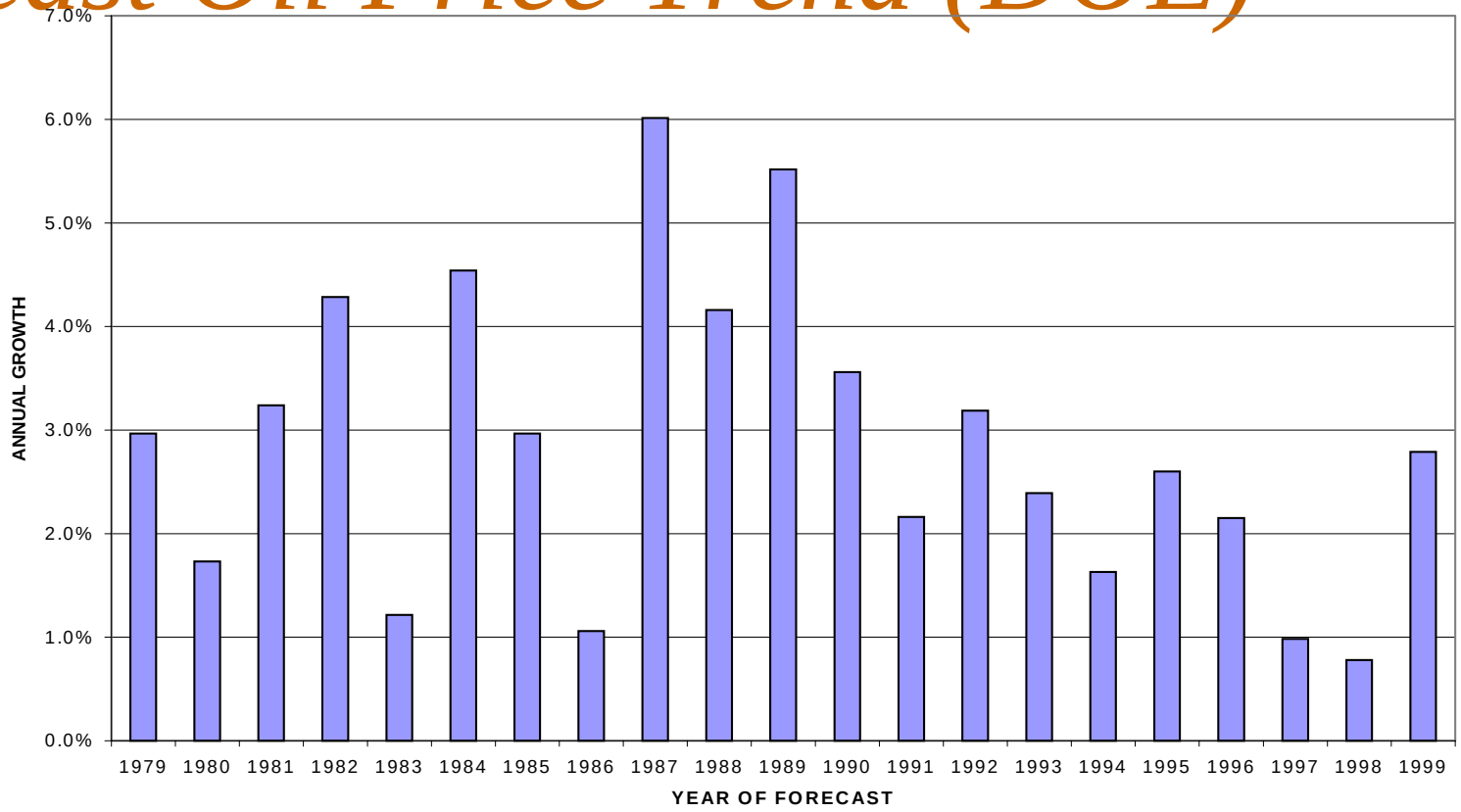
Computers Never Lie



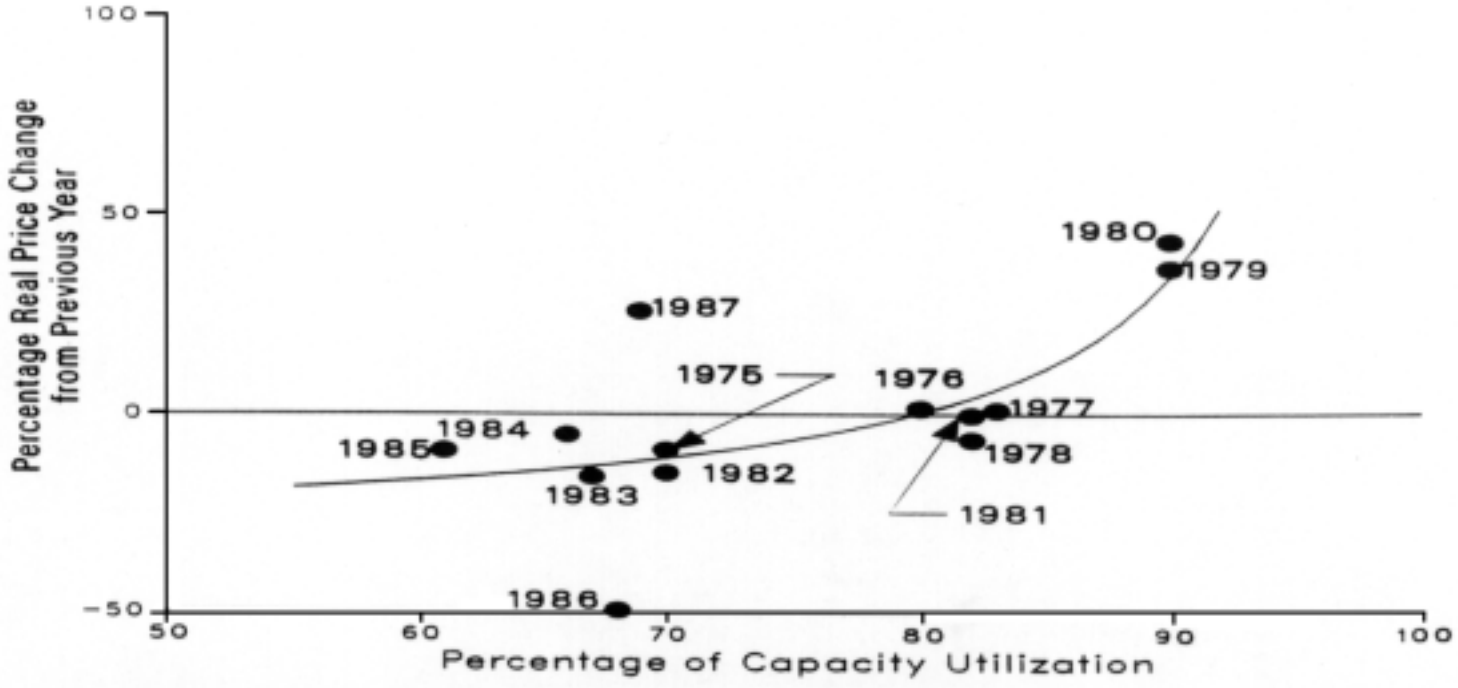
Evolution of DOE Oil Price Forecasts



Forecast Oil Price Trend (DOE)



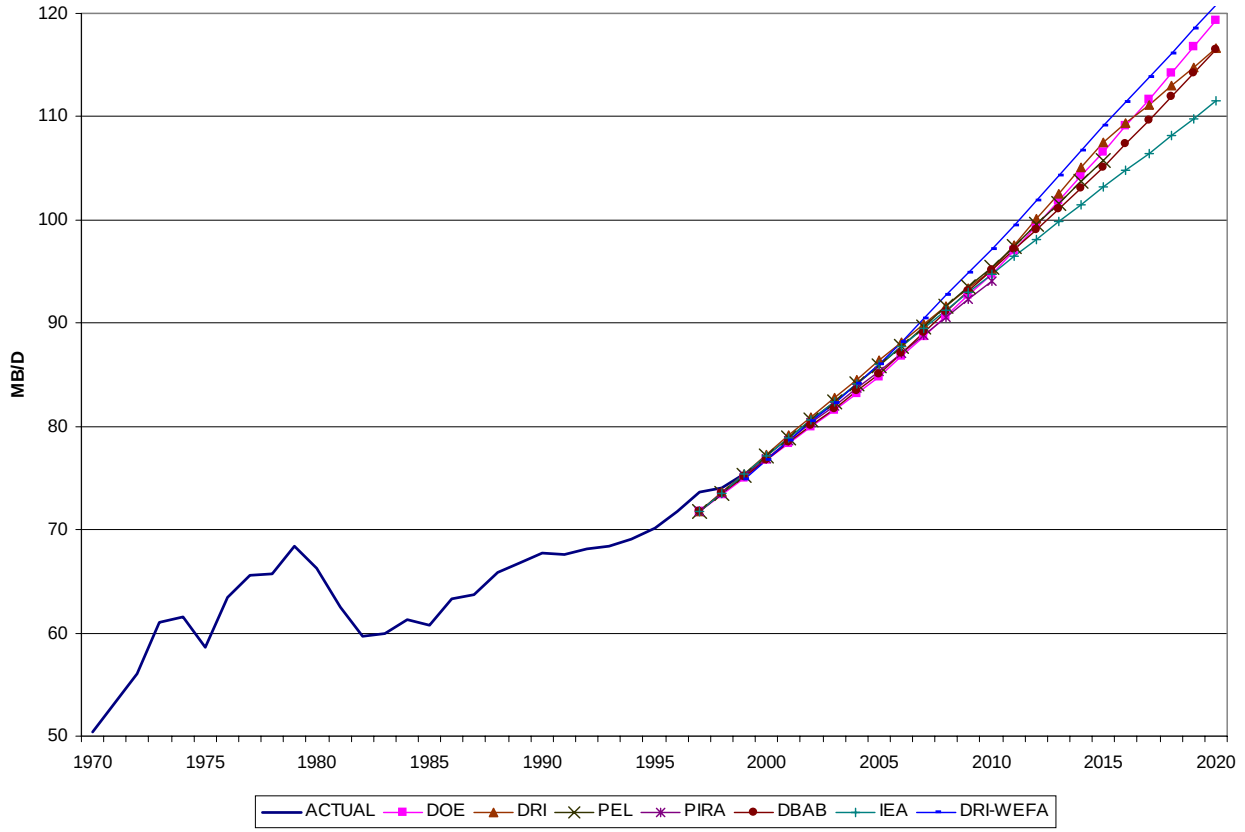
Price Algorithm (von Maelzel's Ghost)



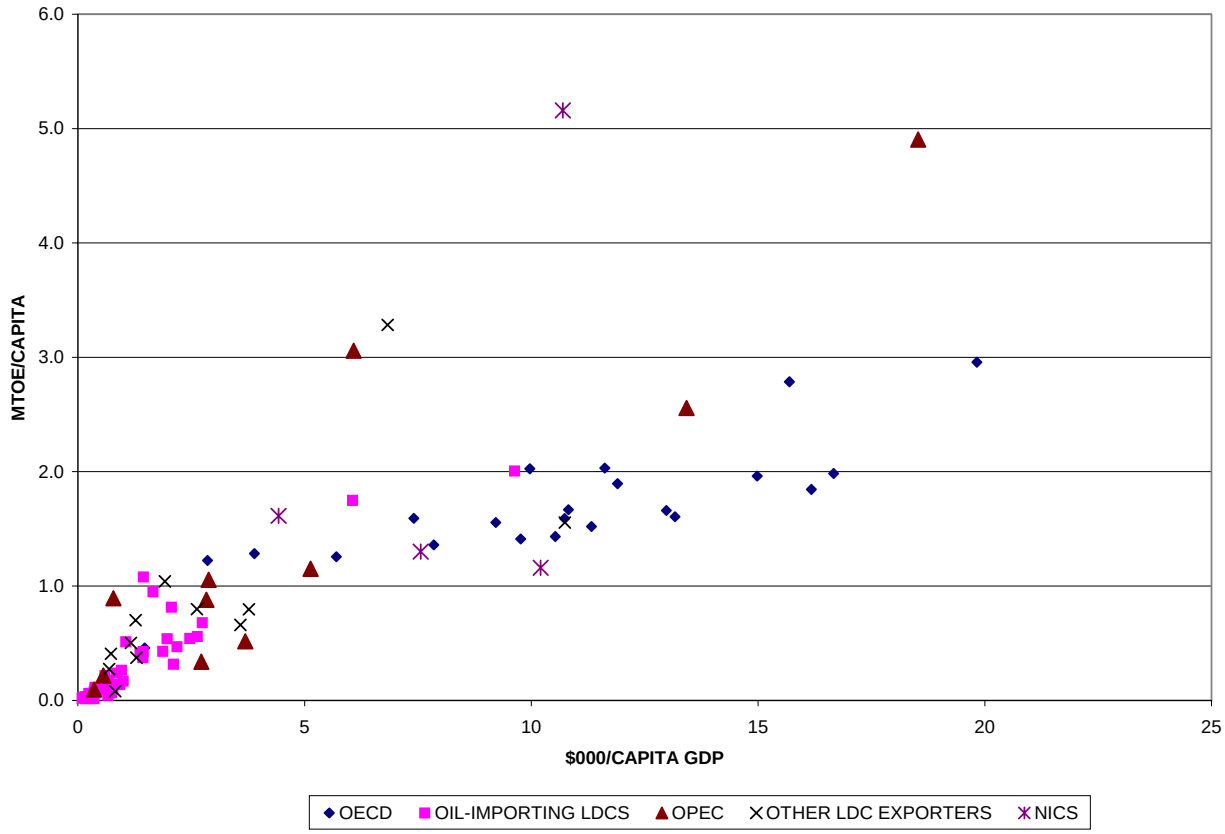
Consumption Is Easy

- High degree of consensus
- Economics is primary element
  - Growth in one yields growth in the other
  - S-Curve
  - Beware Chinese gowns
- Price should not be ignored
  - Crude prices often secondary to taxes
  - Still some price effect on demand
- But substantial policy uncertainties
  - Carbon taxes
  - Nuclear power trends

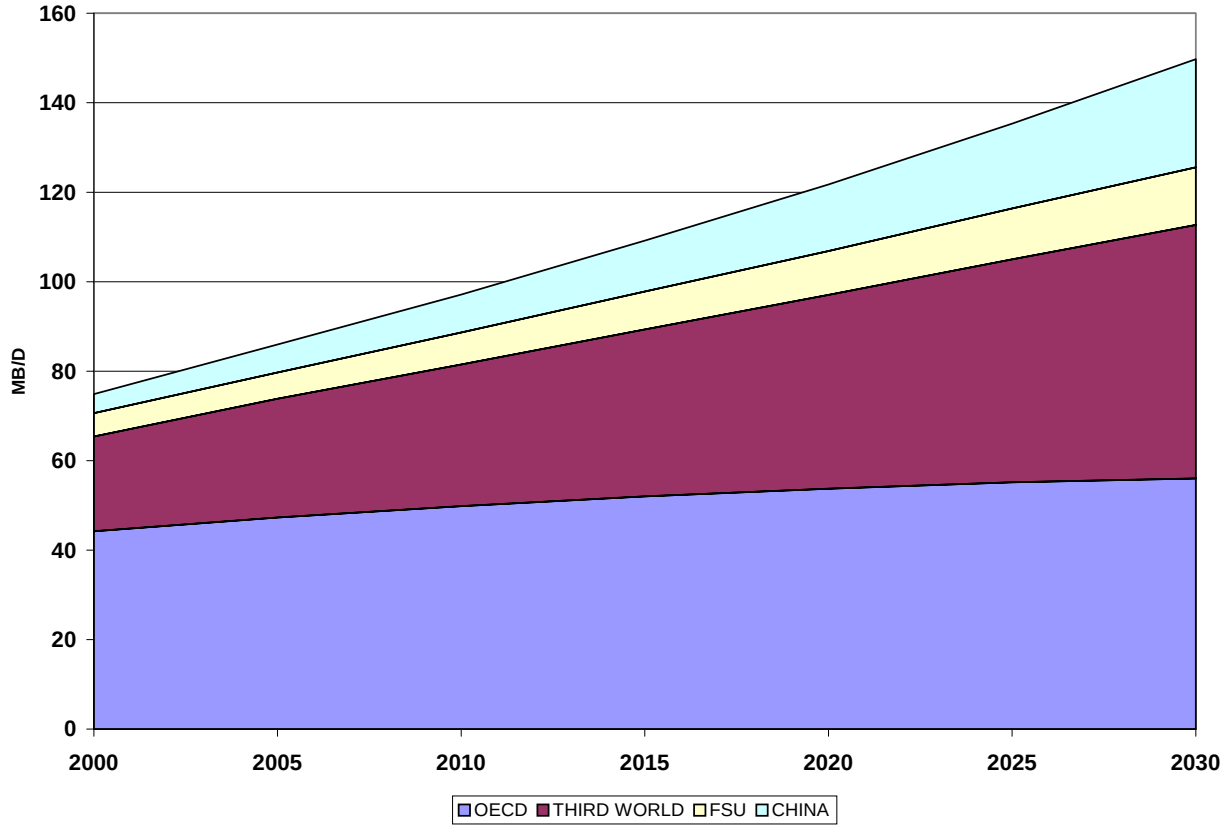
OIL CONSUMPTION FORECASTS



DEMAND=F(GDP)


6.0
5.0
4.0
3.0
2.0
1.0
0.0
MTOE/CAPITA
0
5
10
15
20
25
$000/CAPITA GDP
OECD
OIL-IMPORTING LDCS
OPEC
OTHER LDC EXPORTERS
NICS

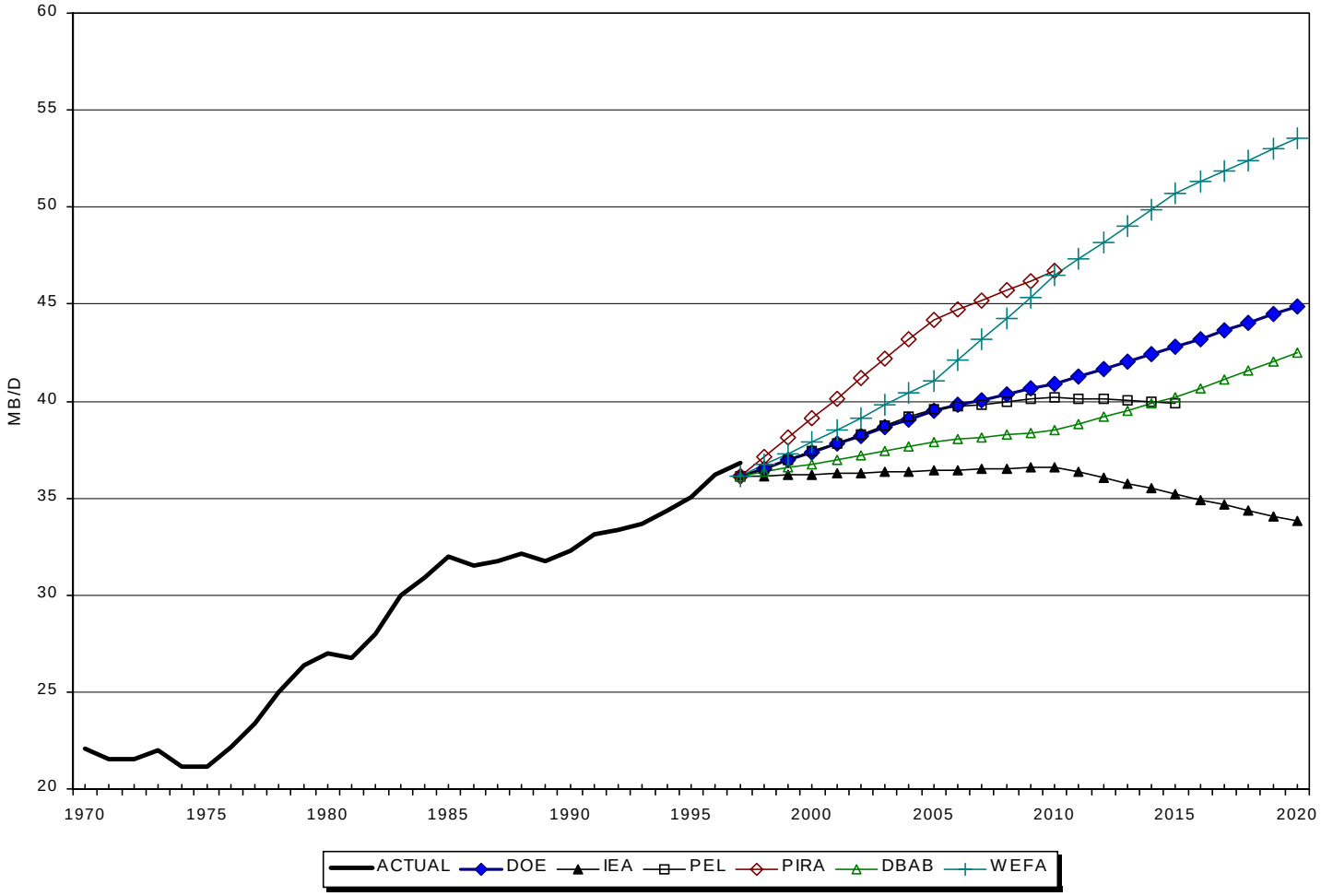
WORLD OIL CONSUMPTION



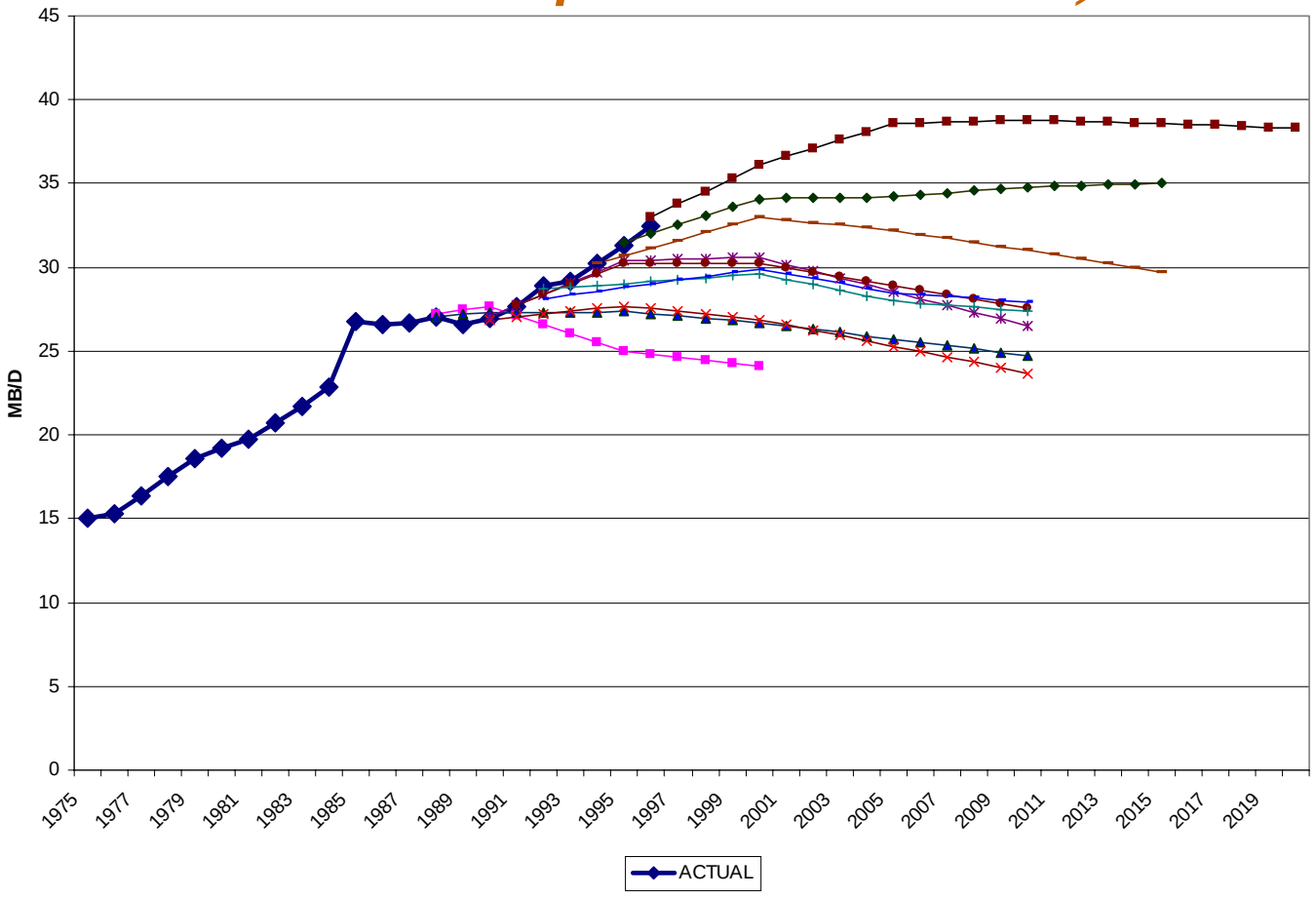
Supply Forecasting More Difficult, Contentious

- Much Less Consensus
- Widely Diverging Theories
  - Hubbert, RTD, Empirical, Top-down
- More Challenging Modeling
  - Poor Data
  - Dummy Variables Dominant
    - Price Controls, Fiscal Regimes
    - Acreage Access
- Implications For Price Forecasting
- See Lynch, 2002 (Quarterly Review of Economics and Finance)

Non-OPEC Oil Production (Excluding FSU)

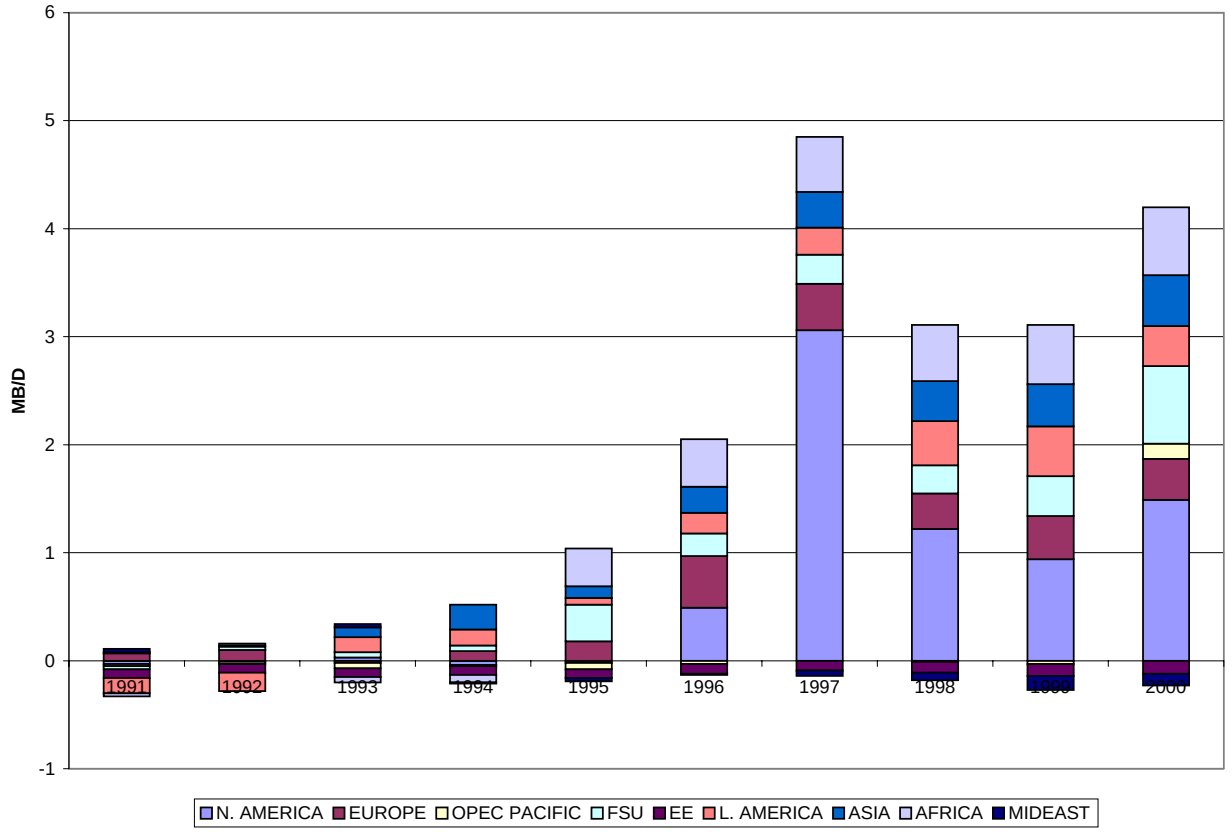


Non-OPEC Production
(DOE Forecasts from 1989 On)



ERROR IN NON-OPEC SUPPLY PROJECTIONS

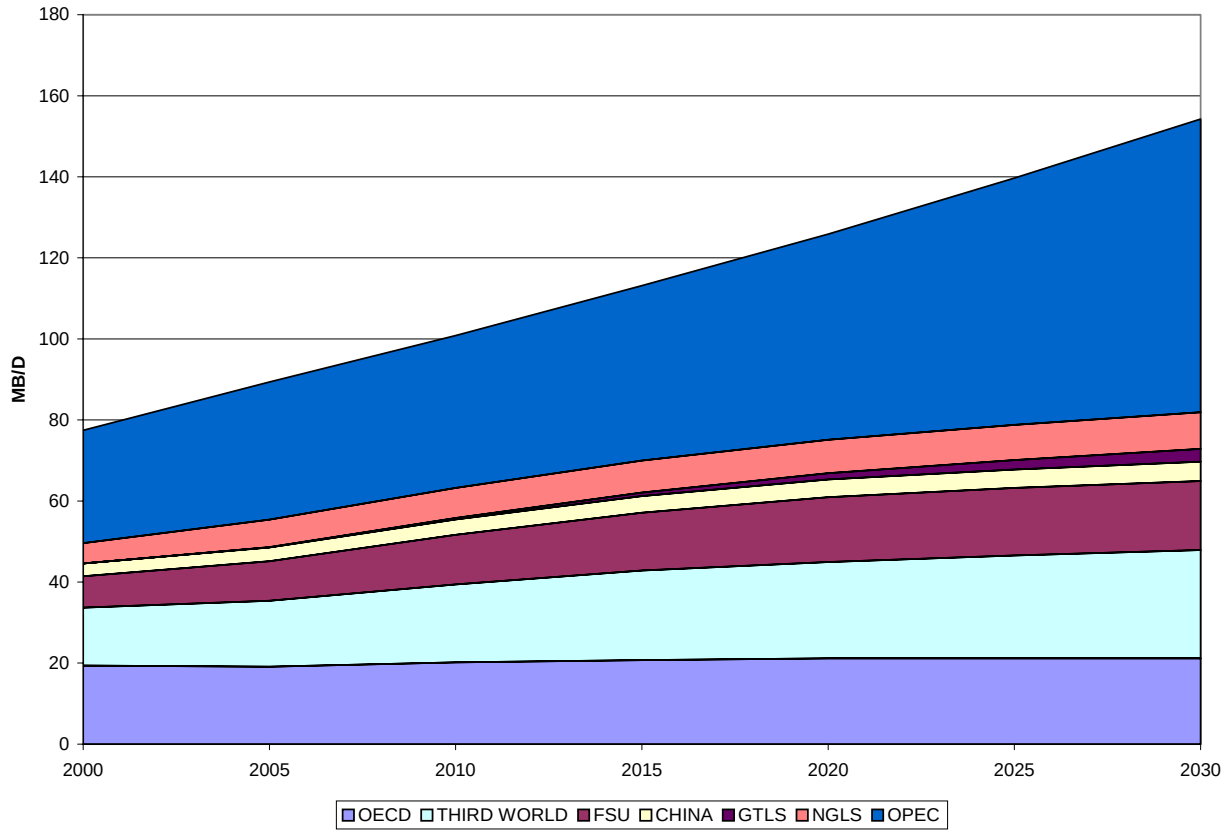
(IEA 1995)



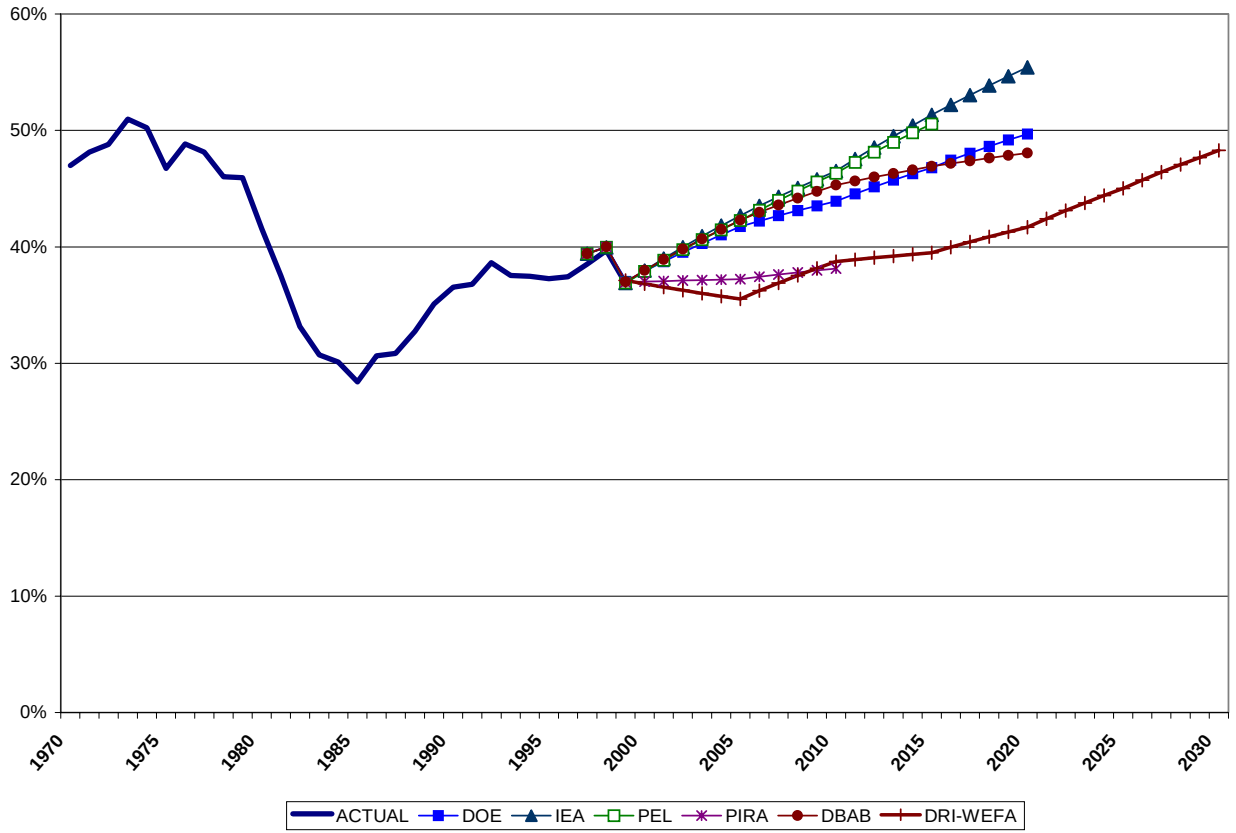
Supply Forecasting

- How and why in Error
  - Always conservative
    - Everybody peaks soon
    - Opposite curve of price forecasts
  - Always pessimistic
    - 95% of forecasts too low
  - Accuracy drops quickly
    - Often only 1-2 years, not 8-10

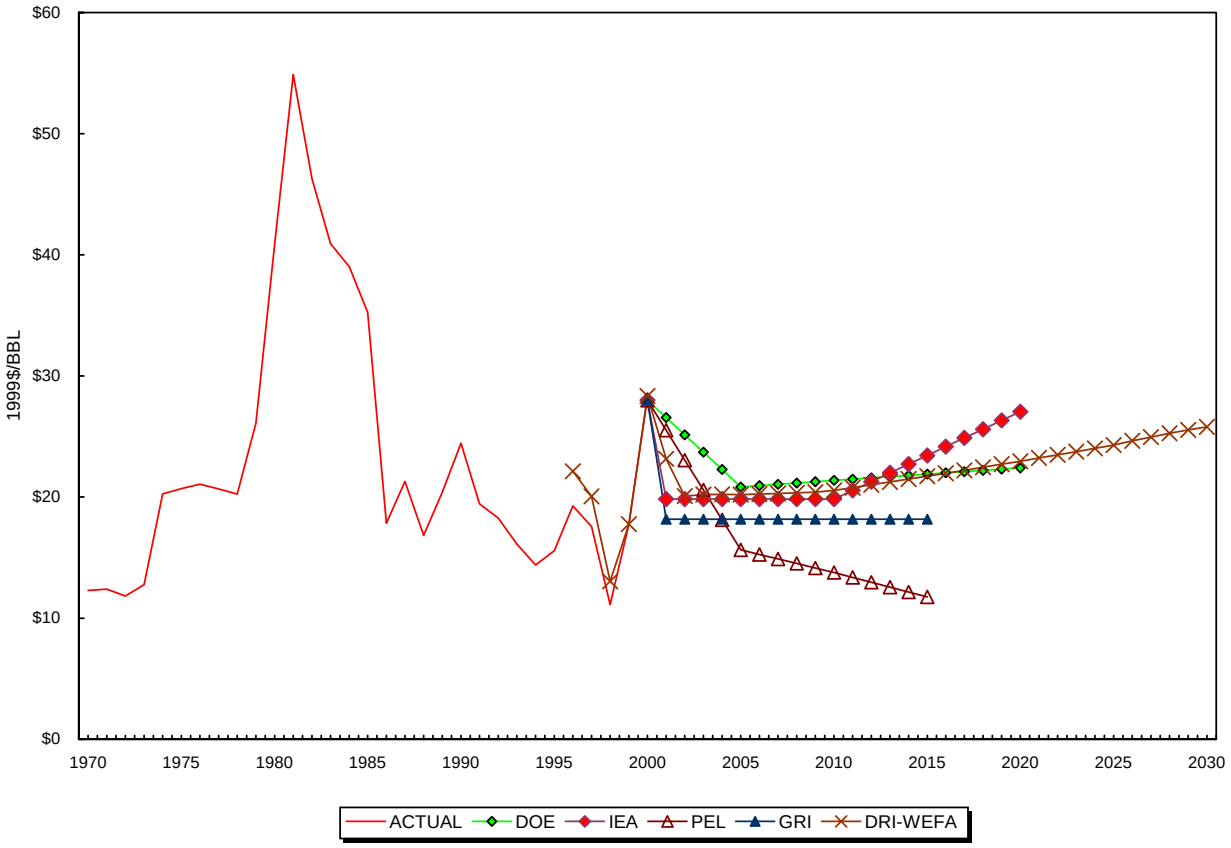
SUPPLY FORECAST



OPEC MARKET SHARE



PRICE OUTLOOK



OPEC MARKET SHARE

- DEMAND LEVEL
  - MACROECONOMY
    - LEVEL OF GROWTH
    - POTENTIAL FOR NEW SHOCKS
- NON-OPEC SUPPLY
    - PRICE/MNOC INVESTMENT
    - DEEPWATER, FSU
    - GTL, TAR SANDS
- OPEC INVESTMENT
  - POLITICAL REGIME (VENEZUELA OR ALGERIA?)
    - APPLIES TO NON-OPEC TOO

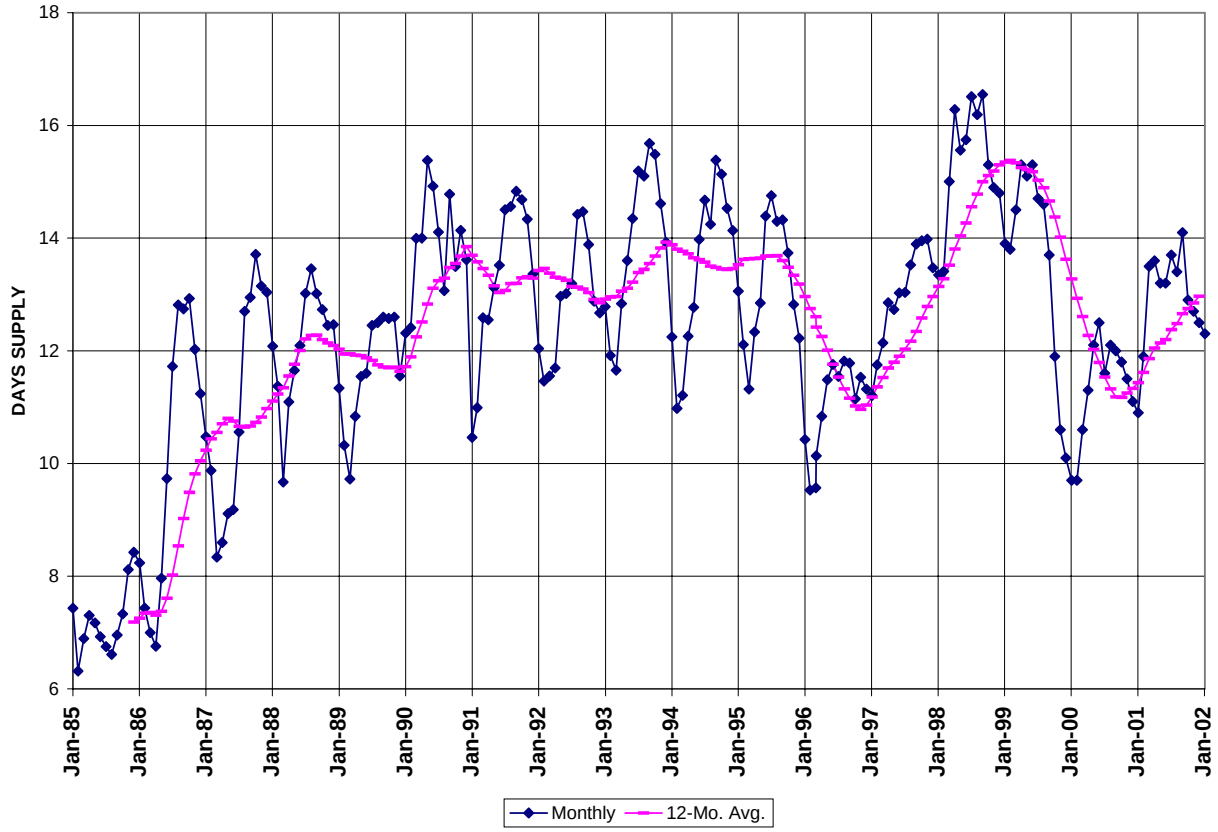
IMPORTANCE OF POLITICS

- **"…there is no guarantee that the current free-market orientation of economic ideology will not swing back towards the left and greater governmental interference in markets or ownership of industry….Also, though, continuing economic problems due to international debt, the recession, bank failures, etc., may cause…policymakers in many developing countries to abandon efforts at market reform." Lynch 1991**

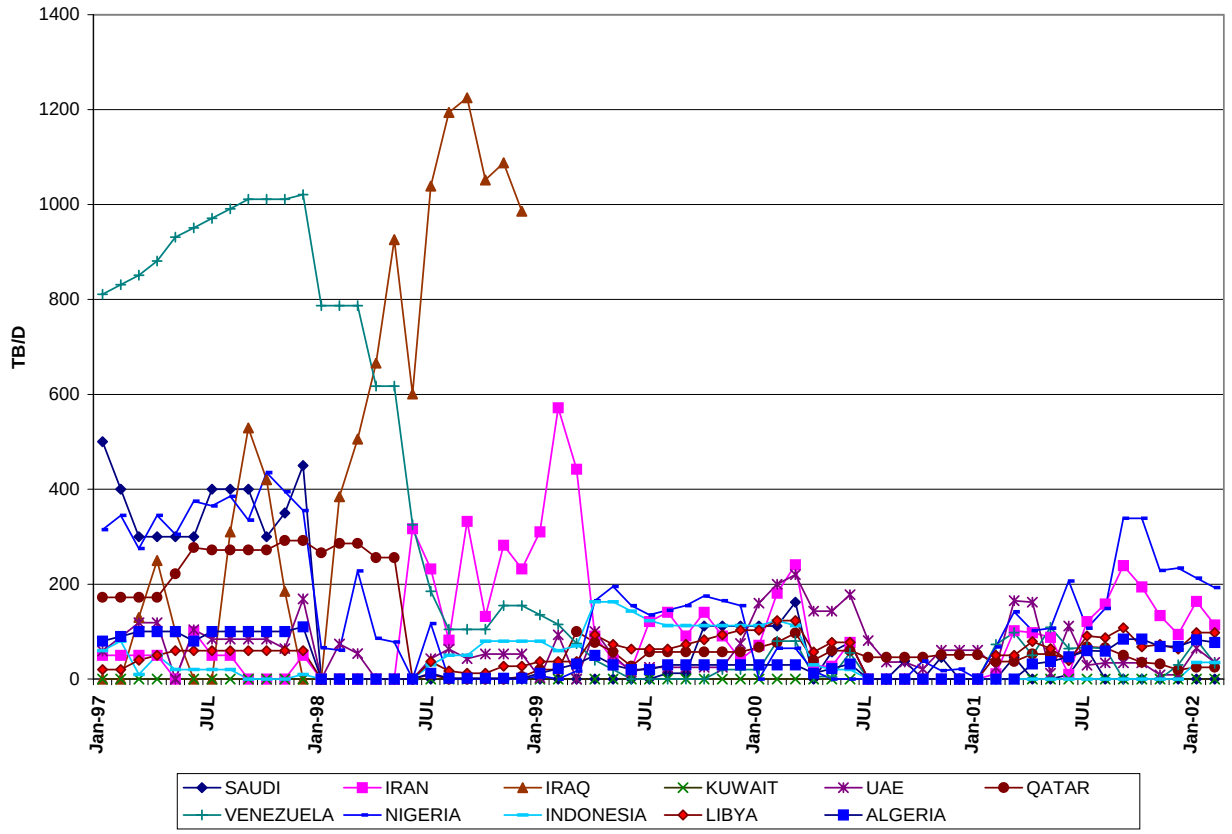
SHORT-TERM MARKET OUTLOOK

- FEARS OF TIGHTENING LATE IN 2002
  - GOOD OPEC DISCIPLINE
  - ECONOMIC RECOVERY (?)
- POSSIBLE NEW COLLAPSE?
  - VENEZUELA, ALGERIA, NIGERIA CHEATING
  - RUSSIA, OTHER NON-OPEC SOARING
  - PRICE IMPACT ON DEMAND

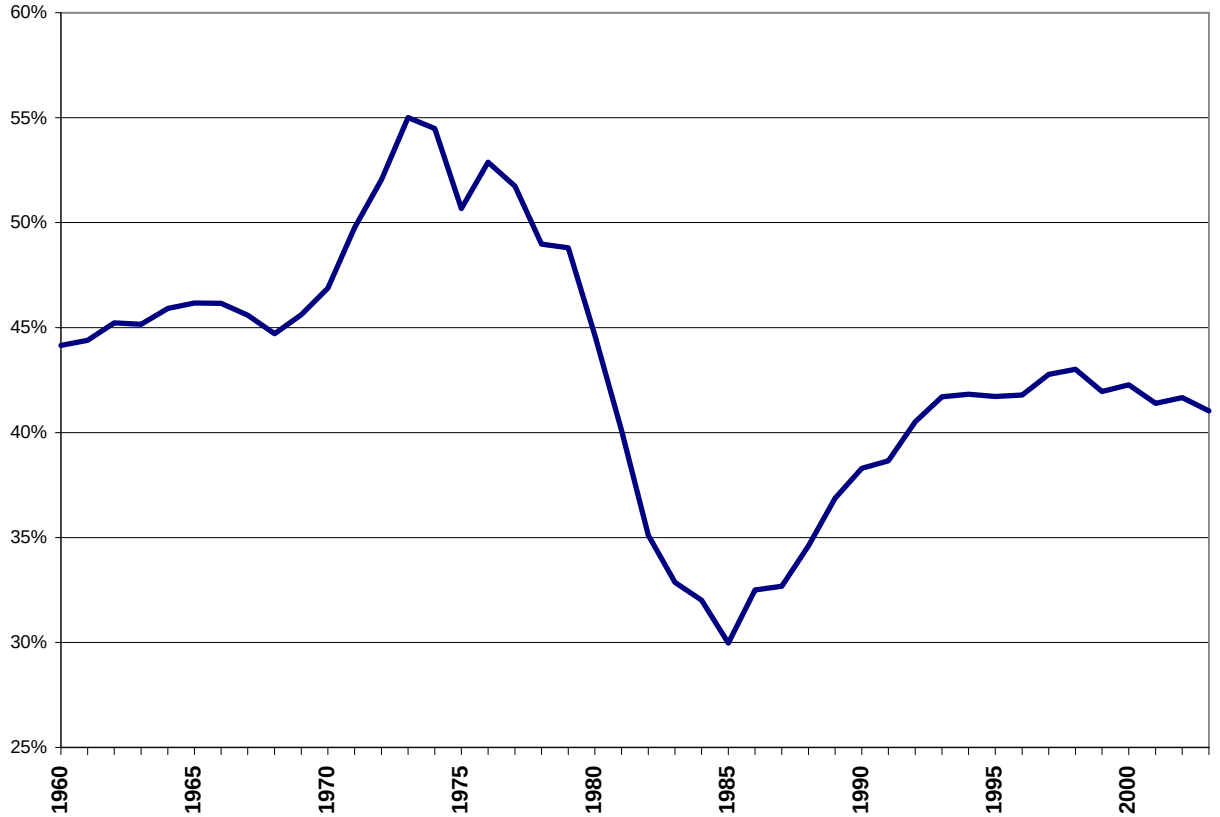
USABLE COMMERCIAL INVENTORIES



PRODUCTION OVER QUOTA

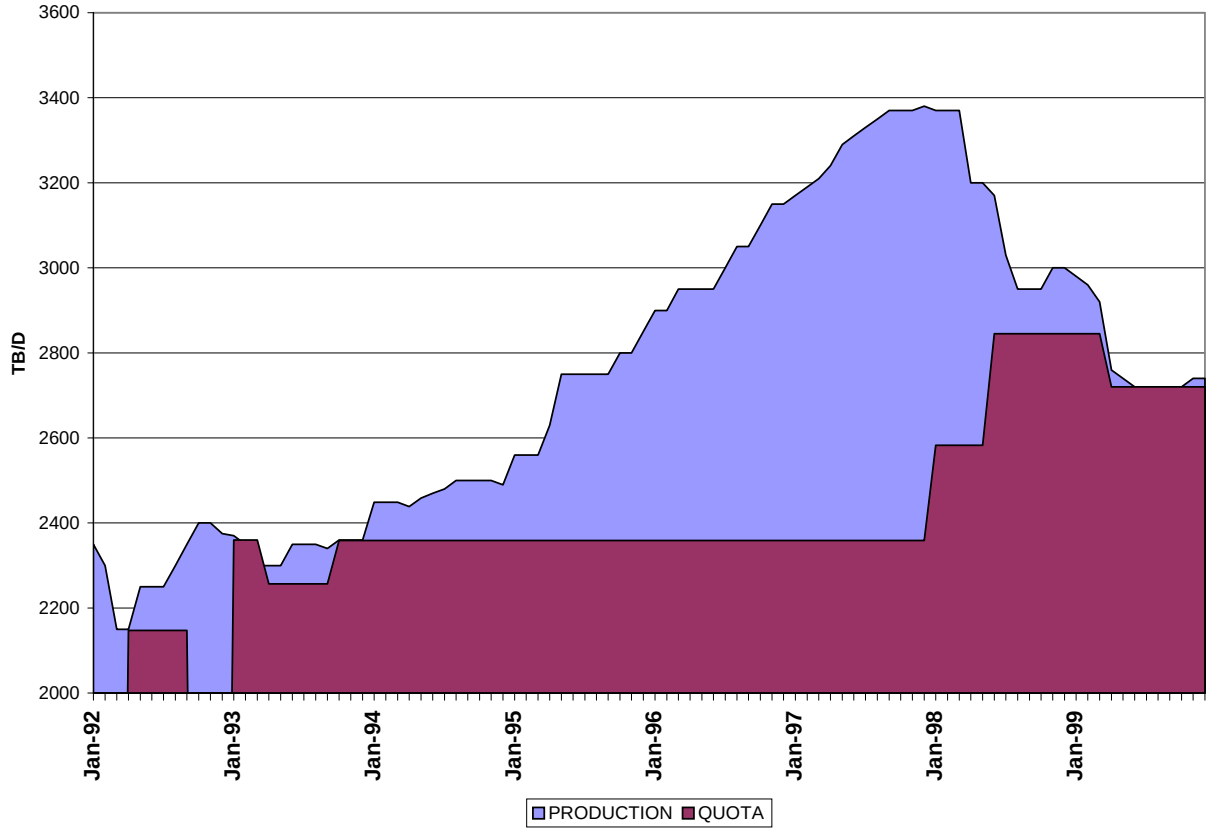


OPEC MARKET SHARE

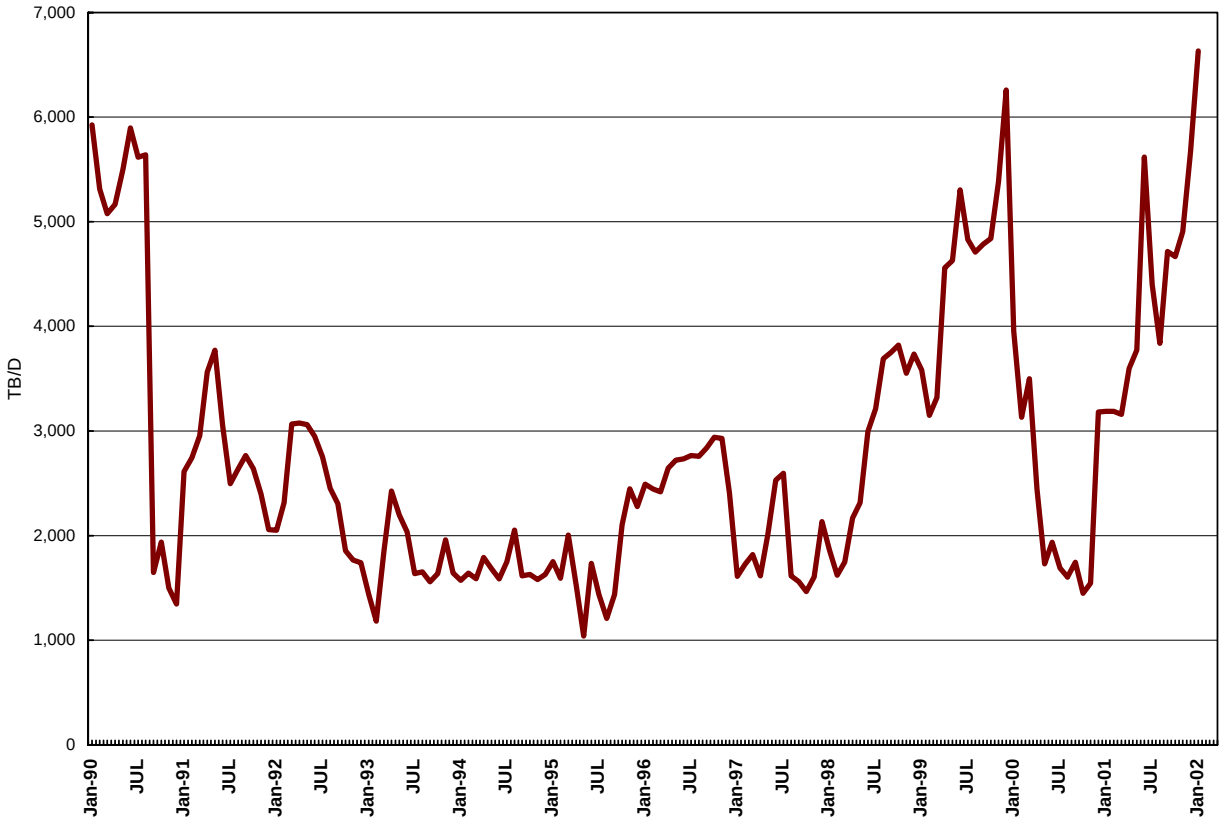


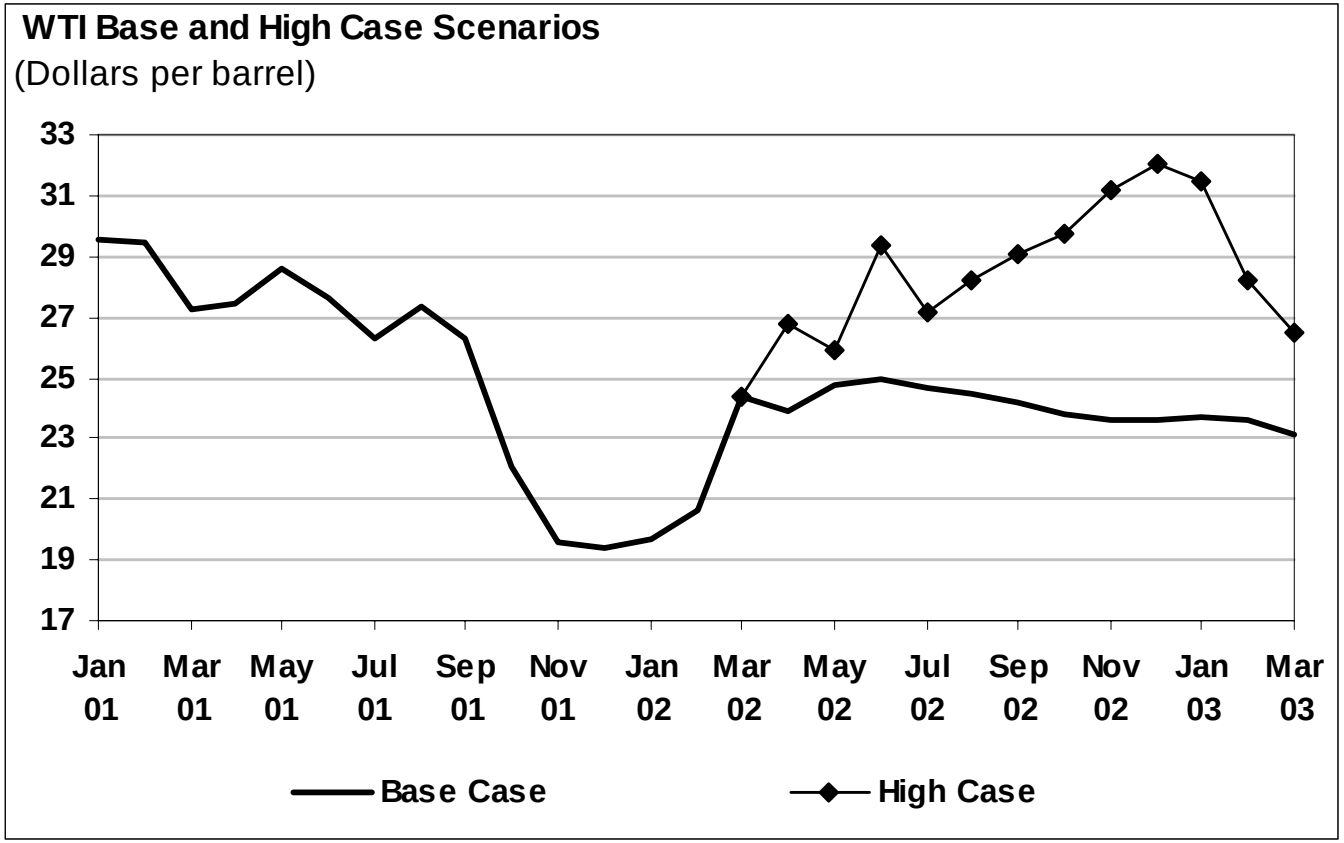
PAST AS PROLOGUE?

VENEZUELAN BEHAVIOR UNDER GIUSTI

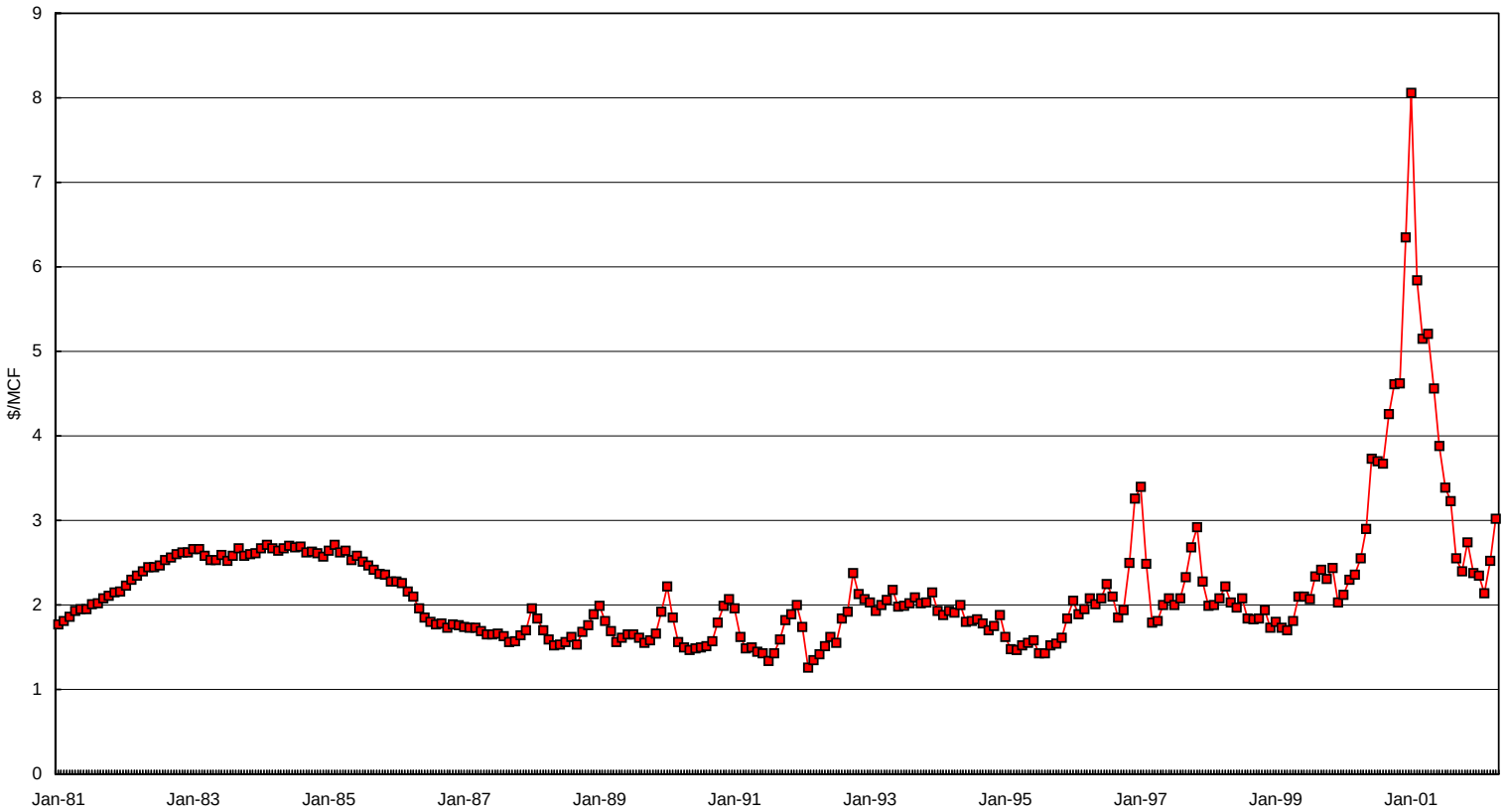


OPEC SURPLUS CAPACITY



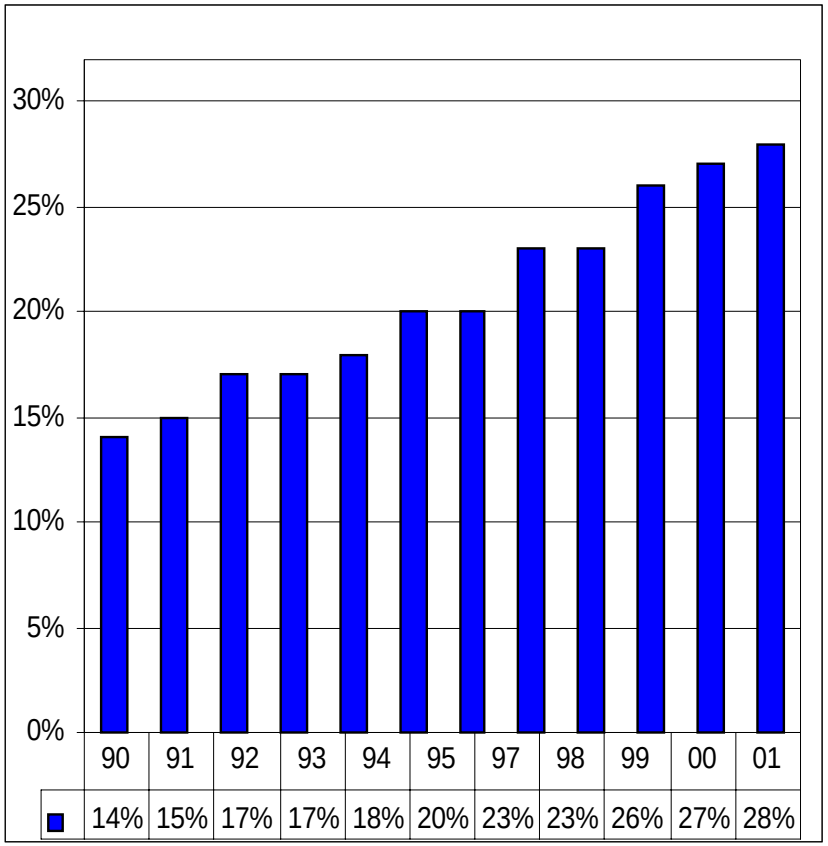

WTI Base and High Case Scenarios
(Dollars per barrel)
33
31
29
27
25
23
21
19
17
Jan 01
Mar 01
May 01
Jul 01
Sep 01
Nov 01
Jan 02
Mar 02
May 02
Jul 02
Sep 02
Nov 02
Jan 03
Mar 03
Base Case
High Case

US GAS MARKET IN TRANSITION?

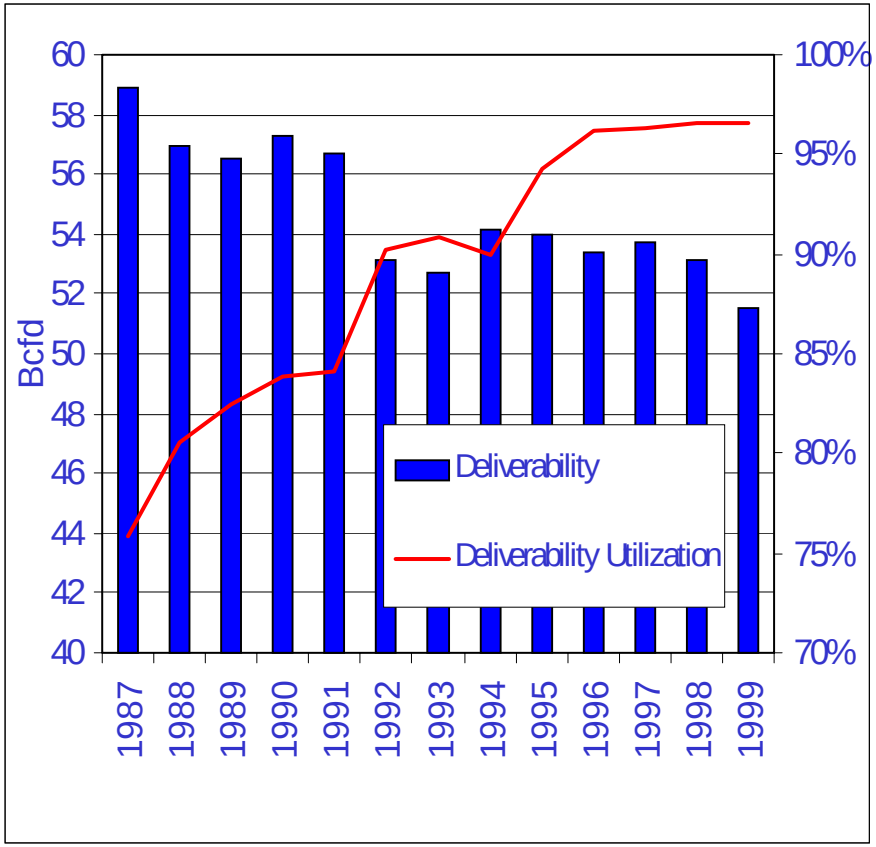


The evidence of serious supply constraints have been strong since 1996.

US Decline Rates Have Increased

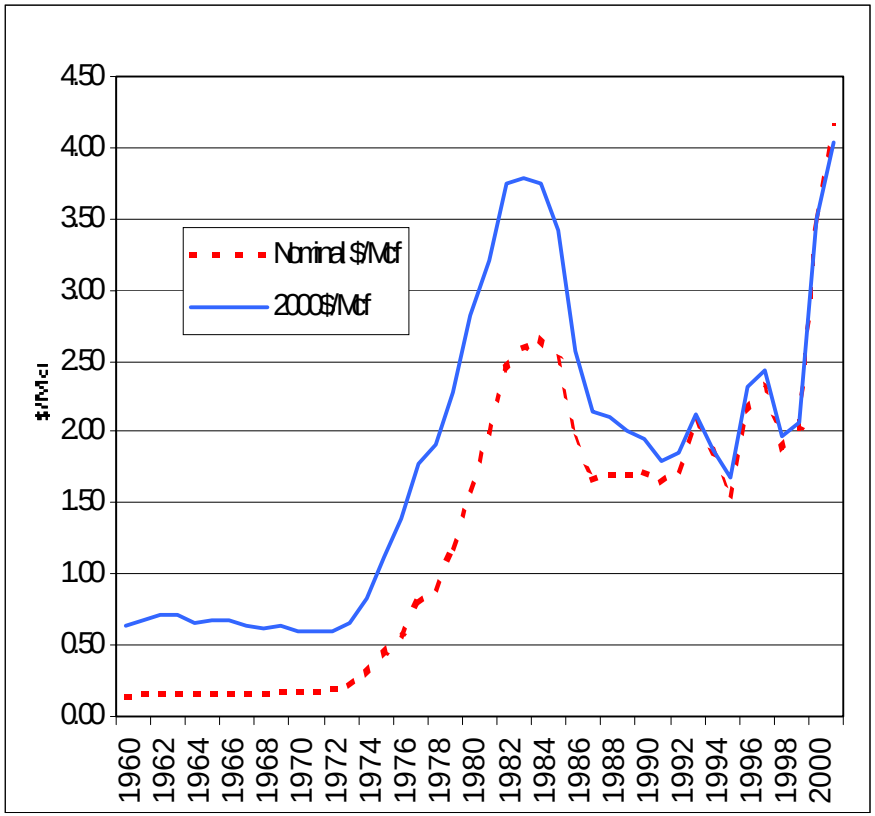


US Deliverability and Utilization

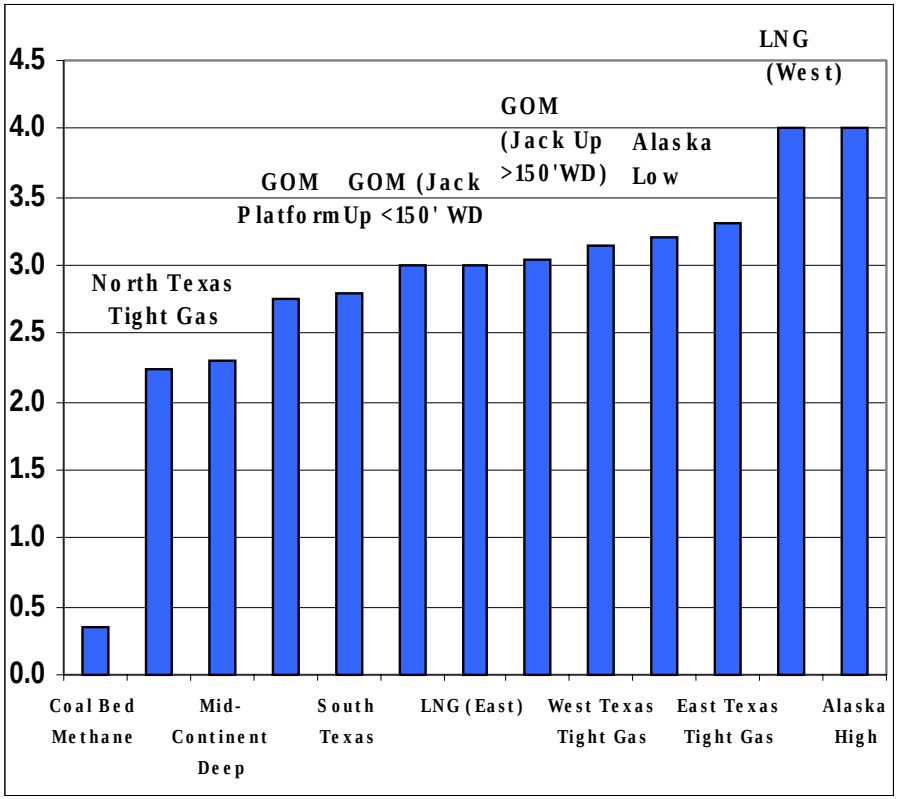


Supply costs are rising. Will prices support LNG and Alaska?

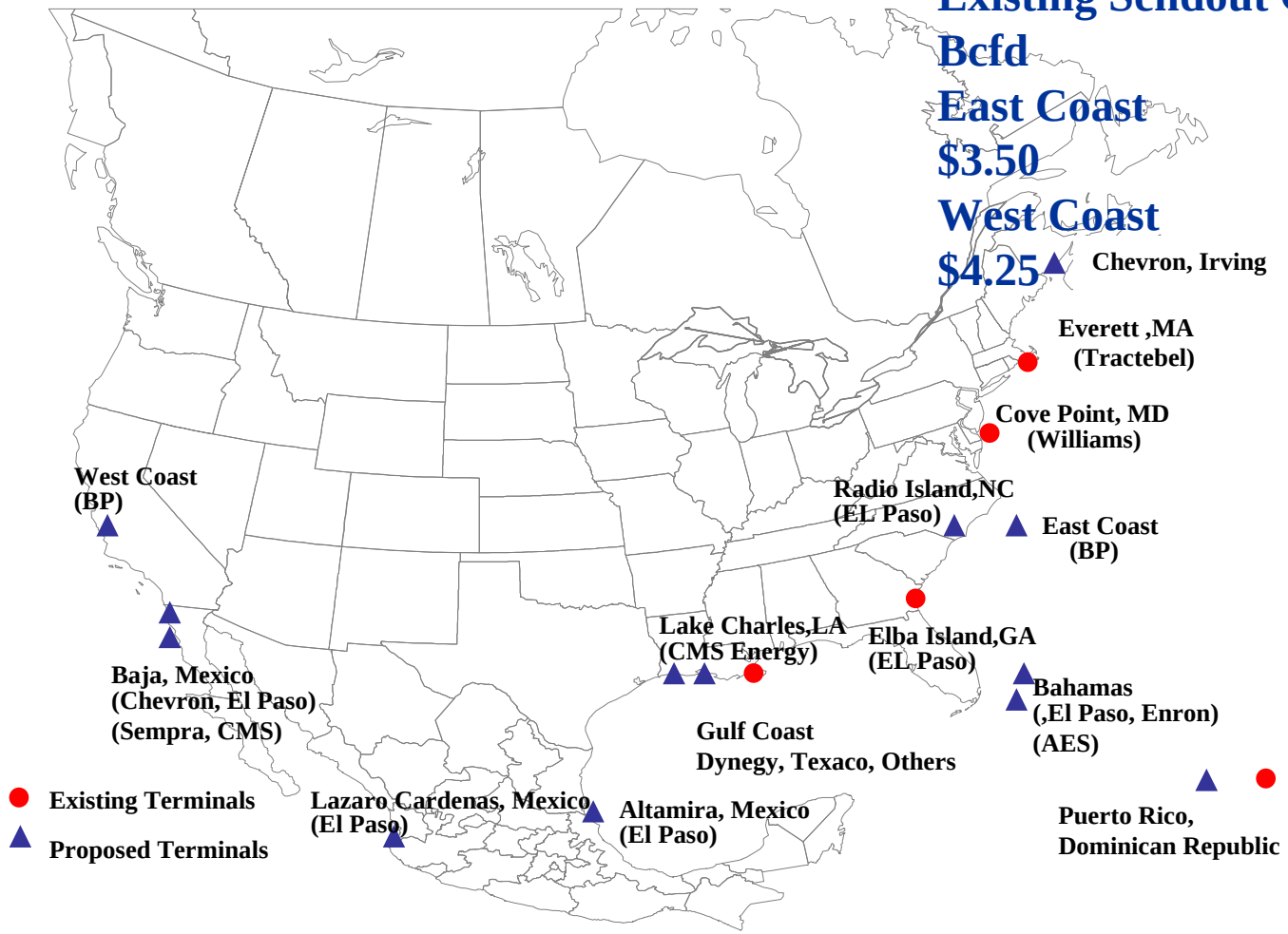
Average Wellhead Prices (1960 - 2001)



Marginal Supply Cost ($2000/MMBtu)



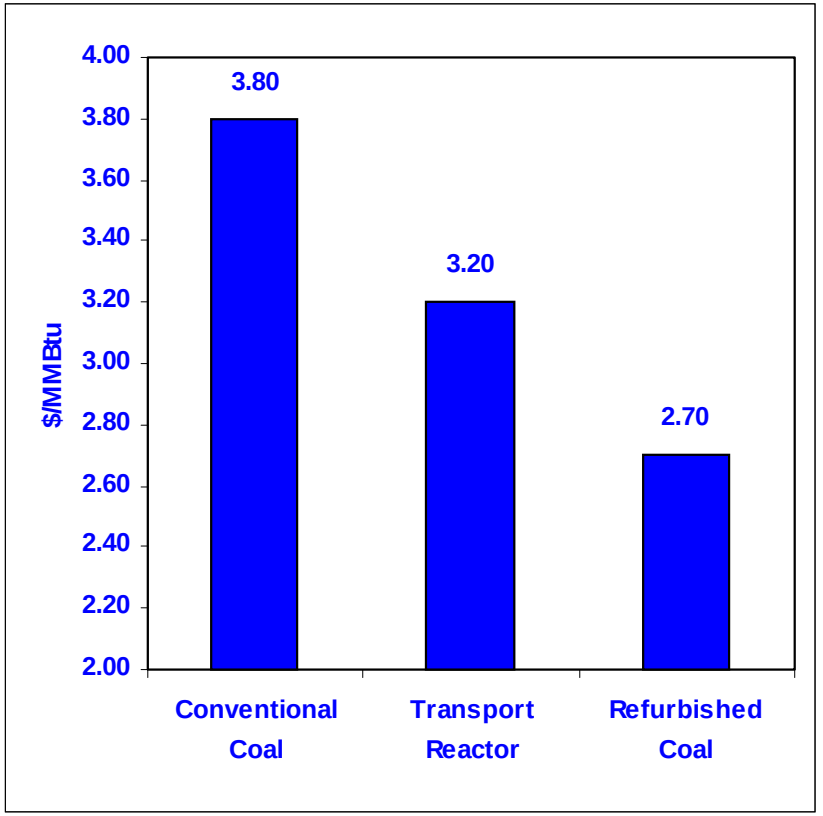
LNG growth will add about 2.5 to 3 Bcfd over the next decade (15+MT LNGe)



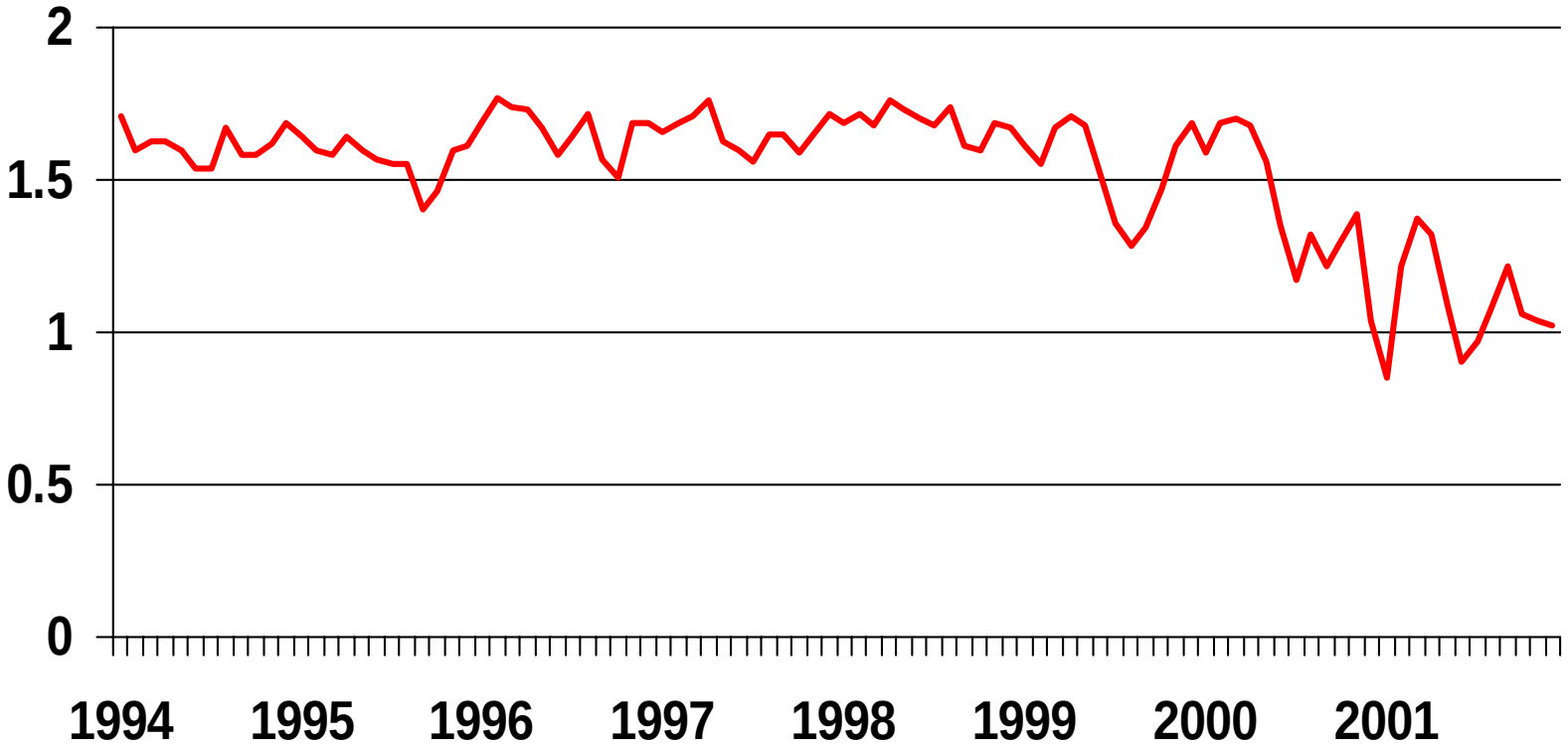
Demand side response will limit gas price increases

- Conventional Coal $3.80 delivered.
- New Source Review
- Refurbished coal capacity is competitive at $2.70 per MMBtu delivered (10% capacity increase).
- Transport reactor is being tested using oil cracking technology to gasify coal.

Delivered Gas Prices that Make Coal Competitive

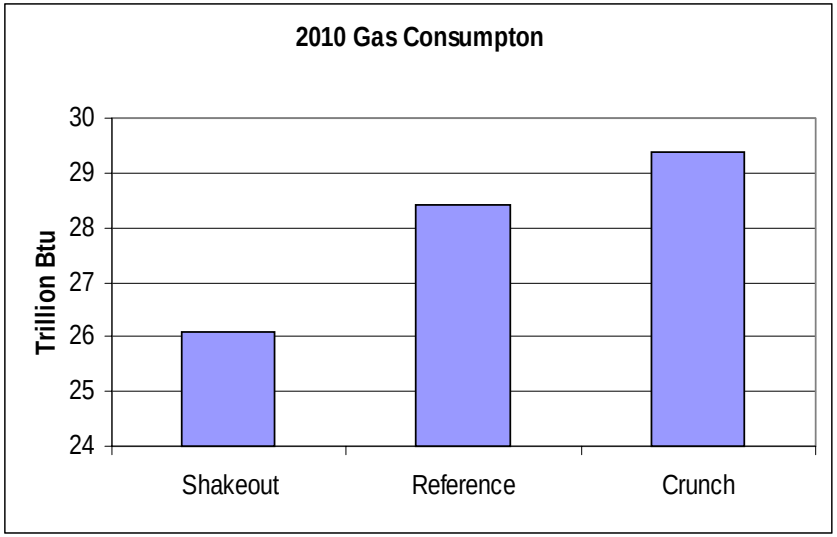


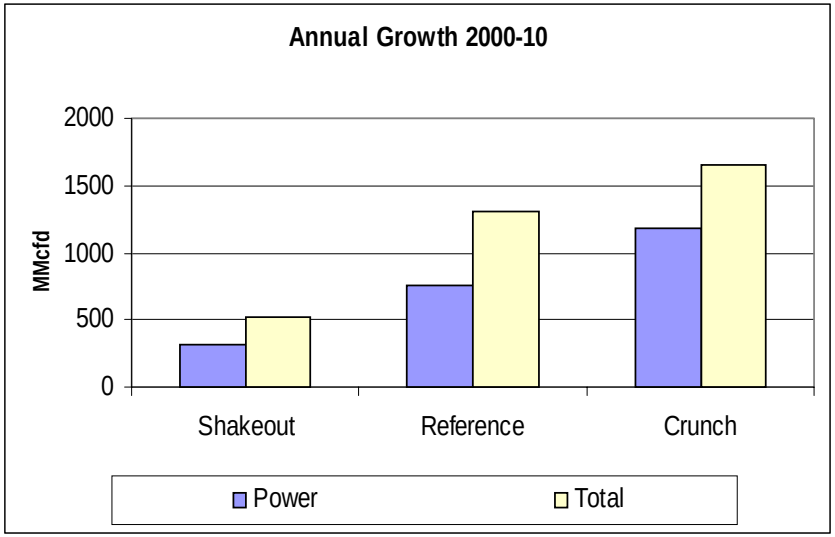
US Natural Gas Use in Ammonia Production Decreases With High Gas Prices in 2000 and 2001 (Bcf/day)



Gas consumption for power generation is a major source of growth and uncertainty

- Gas consumption for power generation is the major source of growth (60% of total).
- Since gas is the marginal fuel, slight changes in generation from other fuels or changes in the electric power growth rate has a major impact.
- Projected growth rates for power generation range from 1.8% to 2.8% per year.
- Scenarios range from optimism to pessimism about coal, nuclear, and power growth rates.





Both supply and demand side uncertainties create a great deal of uncertainty

- Prices in 2010 ($1.90 to $3.65 per MMBtu)
- Need to develop deep wells offshore and onshore, LNG terminals will have to be built
- Growth in supply depends on new discoveries
- Demand response
  - Coal fired plants are likely to play a larger role than many project
  - Increased efficiency in industrial sector
- Environmental Regulations

Average Wellhead Prices
$2000/MMBtu

	2000 (Actual)	2005	2010	2015	2020
AEO	3.69	2.48	2.67	2.81	3.11
AGA	3.69	2.39	2.46	2.55	
DRI*WEFA	3.69	2.91	2.95	3.07	3.16
GRI	3.69	2.12	2.09	2.00	
NPC (Ref)	3.69	2.64	3.13	3.67	
NPC (High)	3.69	2.90	3.65	4.37	
NPC (Low)	3.69	2.26	2.28	3.07	
NRCan*	3.69		2.12		2.12
Average		2.53	2.94	3.08	2.80
Deflator	1.00	1.14	1.26	1.41	1.57

* Forecast were developed in 1999.

CONCLUSION (1): THINGS HAVE CHANGED

- MARKETS TIGHTER THAN BEFORE
  - CAPACITY UTILIZATION VERY HIGH COMPARED TO 1980S, EARLY 1990S
- OPEC MORE COHESIVE
- POLITICAL TREND REVERBERATING TOWARDS INTERVENTION IN MARKETS

CONCLUSION (2): THE MORE THEY ARE THE SAME

- PRICE EFFECTS STILL POWERFUL
  - AND UNDERESTIMATED
- GOVERNMENTS NOT AS BAD AS BEFORE
- UNCERTAINTIES ENORMOUS
  - POLICY, PRICE, TECHNOLOGY, EVEN GDP GROWTH
- ANALYSIS IS THE ANSWER (RELATIVELY)