GTSP

Global Energy Technology Strategy Program

The History of the Future Price of Oil

JJ Dooley, MA Wise and PJ Runci

Joint Global Change Research Institute

May 28, 2008

PNNL-SA-60763

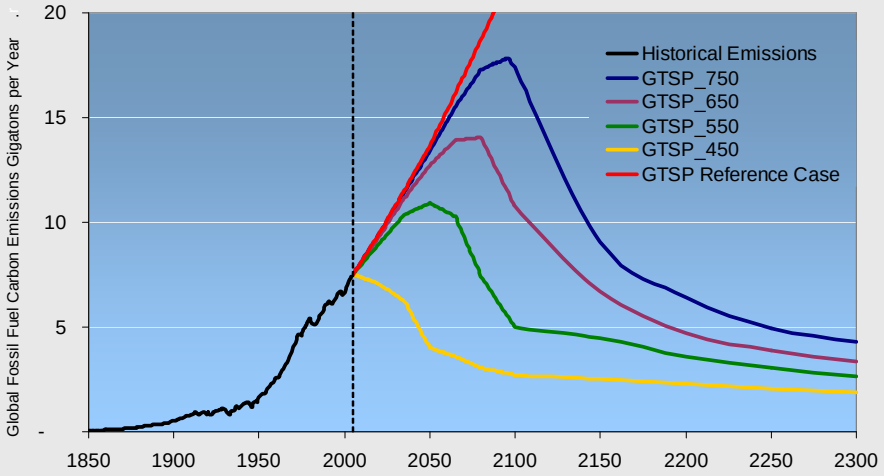
Battelle | Office of Science U.S. Department of Energy | JGCRI Joint Global Change Research Institute | University of Maryland

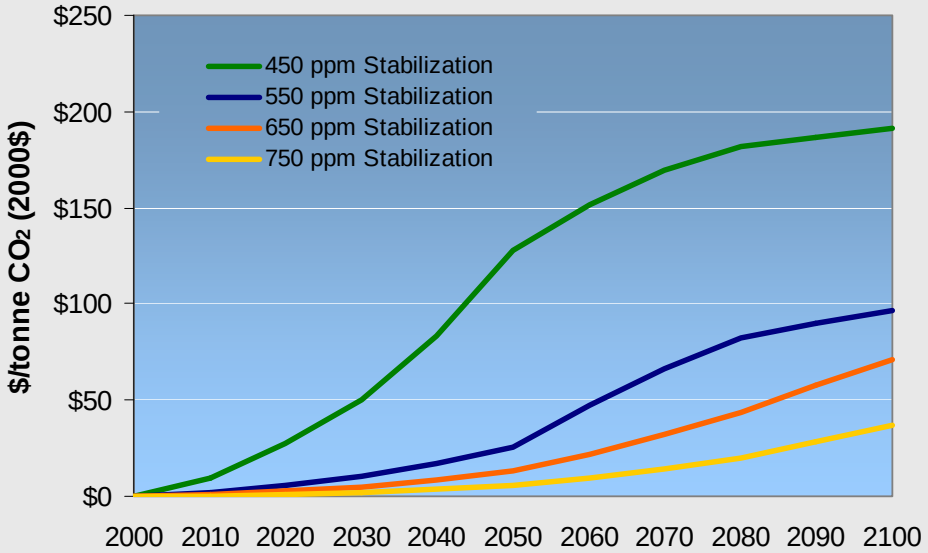
Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Climate change is a long-term strategic problem with implications for today

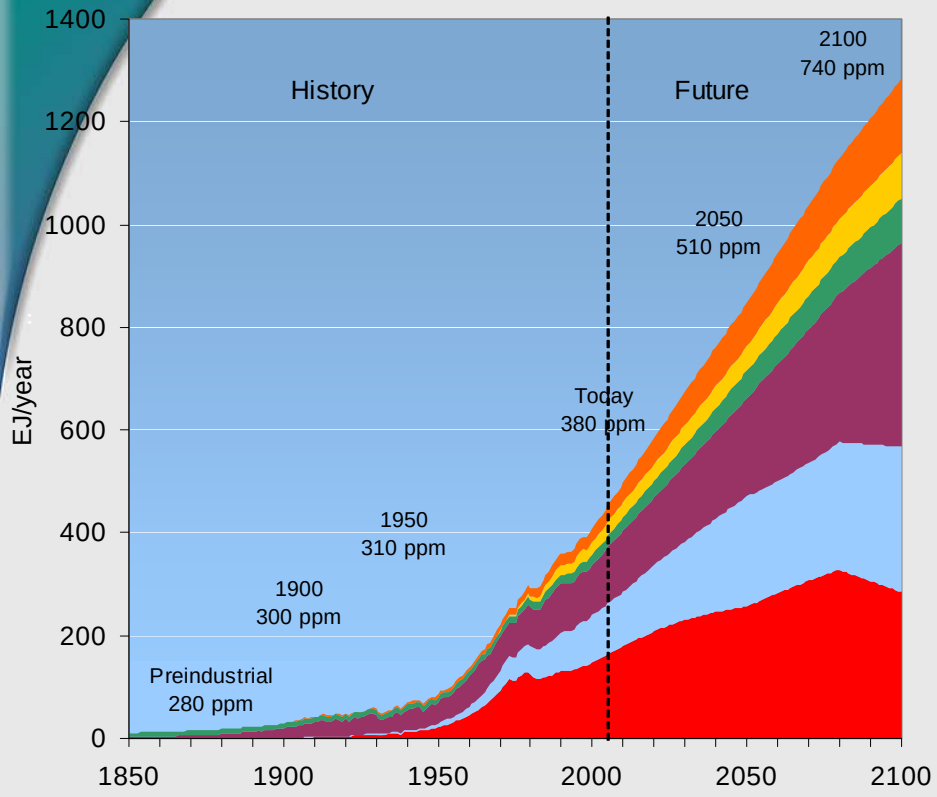
- Stabilizing atmospheric concentrations of greenhouse gases and not their annual emissions levels should be the overarching strategic goal of climate policy.

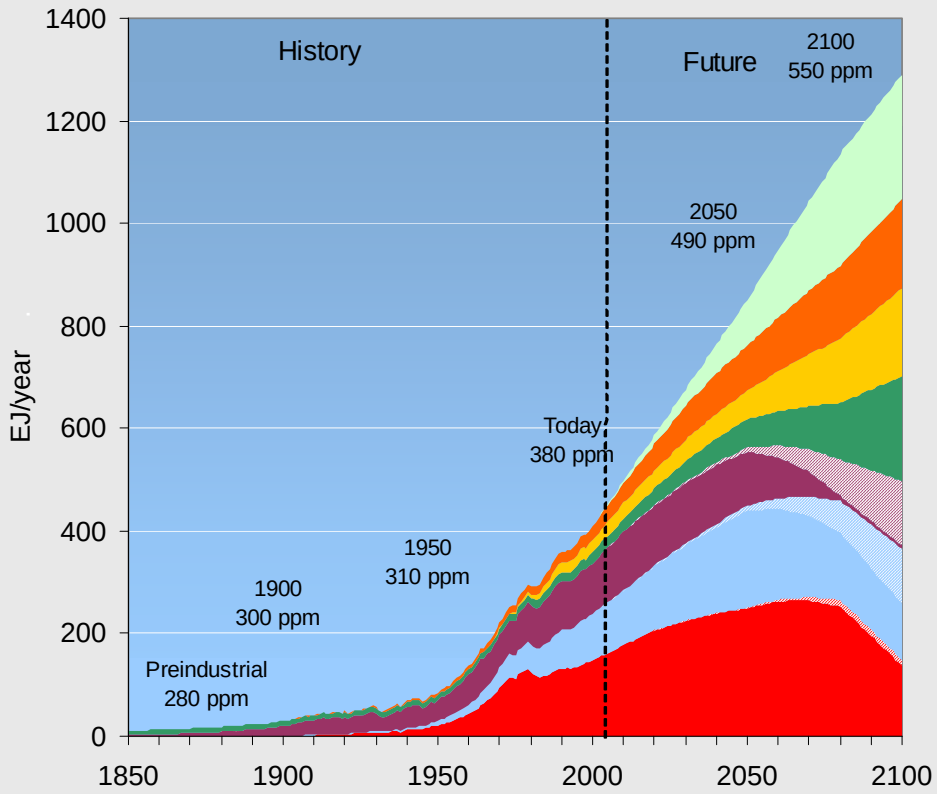
- This tells us that a fixed and finite amount of CO_2 can be released to the atmosphere over the course of this century.
  - We all share a planetary greenhouse gas emissions budget.
  - Every ton of emissions released to the atmosphere reduces the budget left for future generations.
  - As we move forward in time and this planetary emissions budget is drawn down, the remaining allowable emissions will become more valuable.
  - Emissions permit prices should steadily rise with time.





Stabilization of CO_2 concentrations means fundamental change to the global energy system

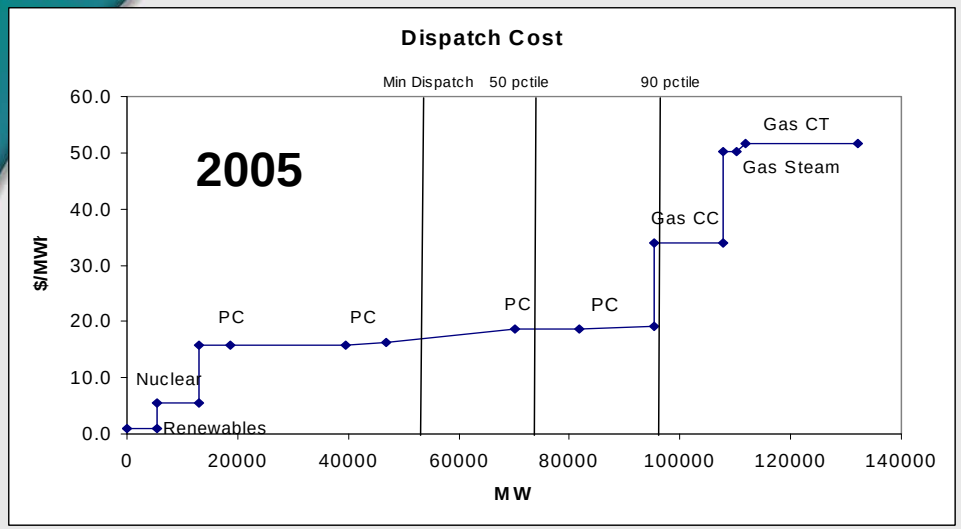


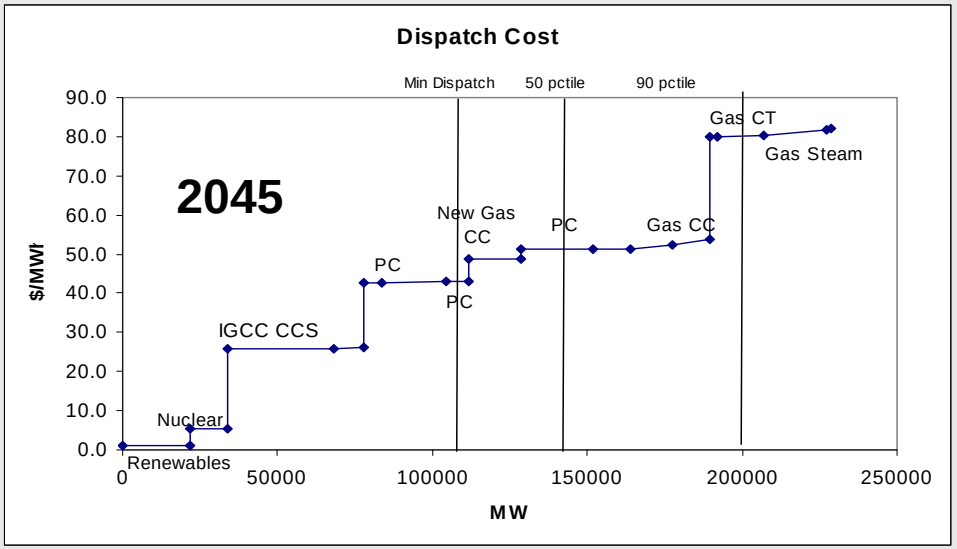


- Oil
- Natural Gas
- Coal
- Biomass Energy
- Non-Biomass Renewable Energy
- Oil + CCS
- Natural Gas + CCS
- Coal + CCS
- Nuclear Energy
- End-use Energy

CCS Deployment by Electric Utilities

IGCC+CCS and Nuclear Are Keys to Decarbonizing Baseload Power





- In 2005, conventional fossil-fired power plants were the predominant means of generating competitively priced electricity.
- However, given today's and (likely) tomorrow's higher natural gas prices and the imposition of a hypothetical binding greenhouse gas control policy,
  - While renewables are likely to grow substantially, IGCC+CCS and nuclear become -- in some regions of the U.S. -- the dominant means of generating low-carbon *baseload* electricity.

Two Core Principals for Good Guide Climate Policy (Edmonds, 1999)

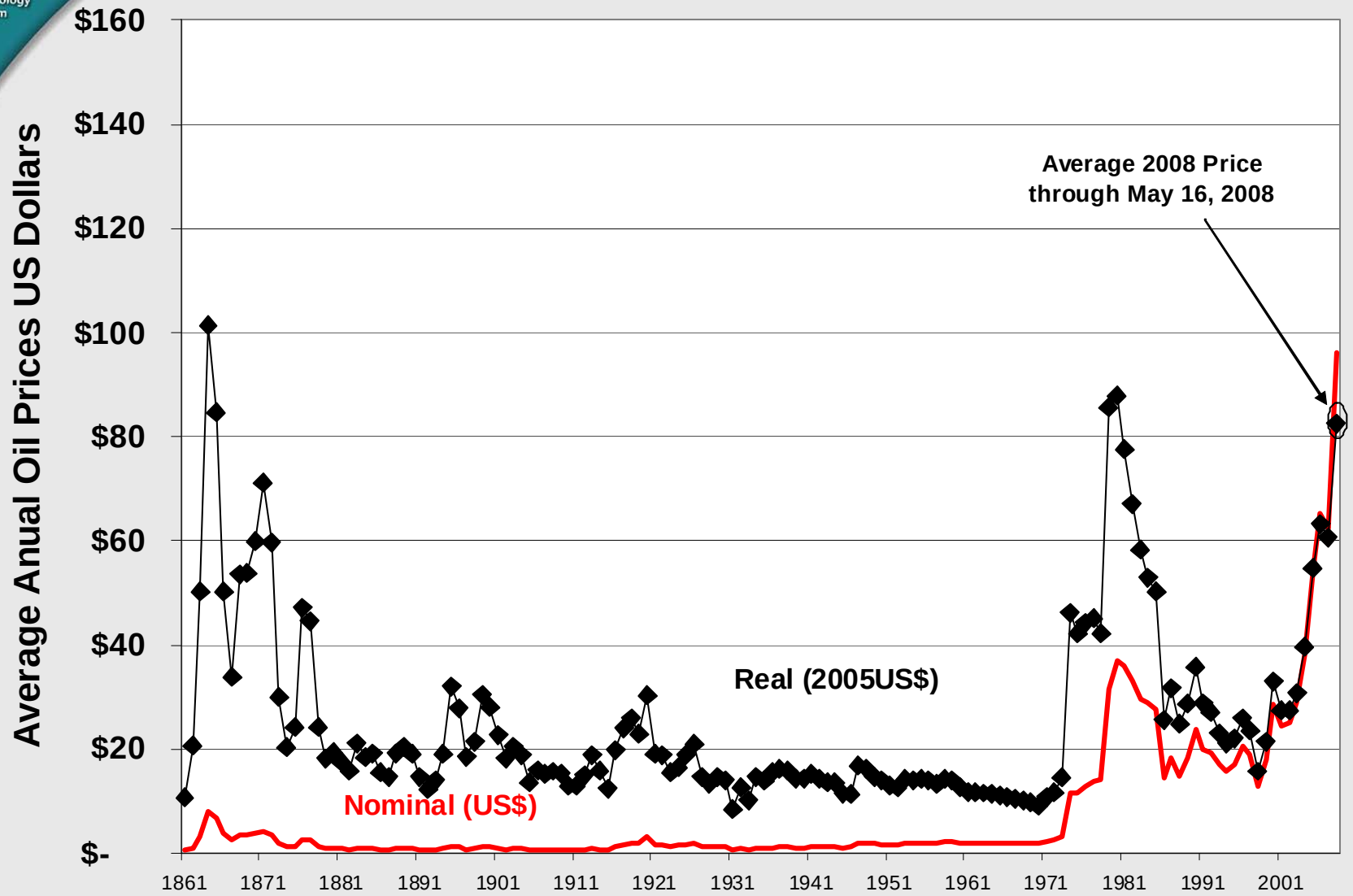
Credible Commitment

There needs to be a credible expectation that the future energy regime will be different than the past. Technology maturation cycles are significantly longer than political cycles, the Commitment must be binding and transcend multiple political cycles for non-carbon energy technologies to have a chance of achieving significant market penetration.

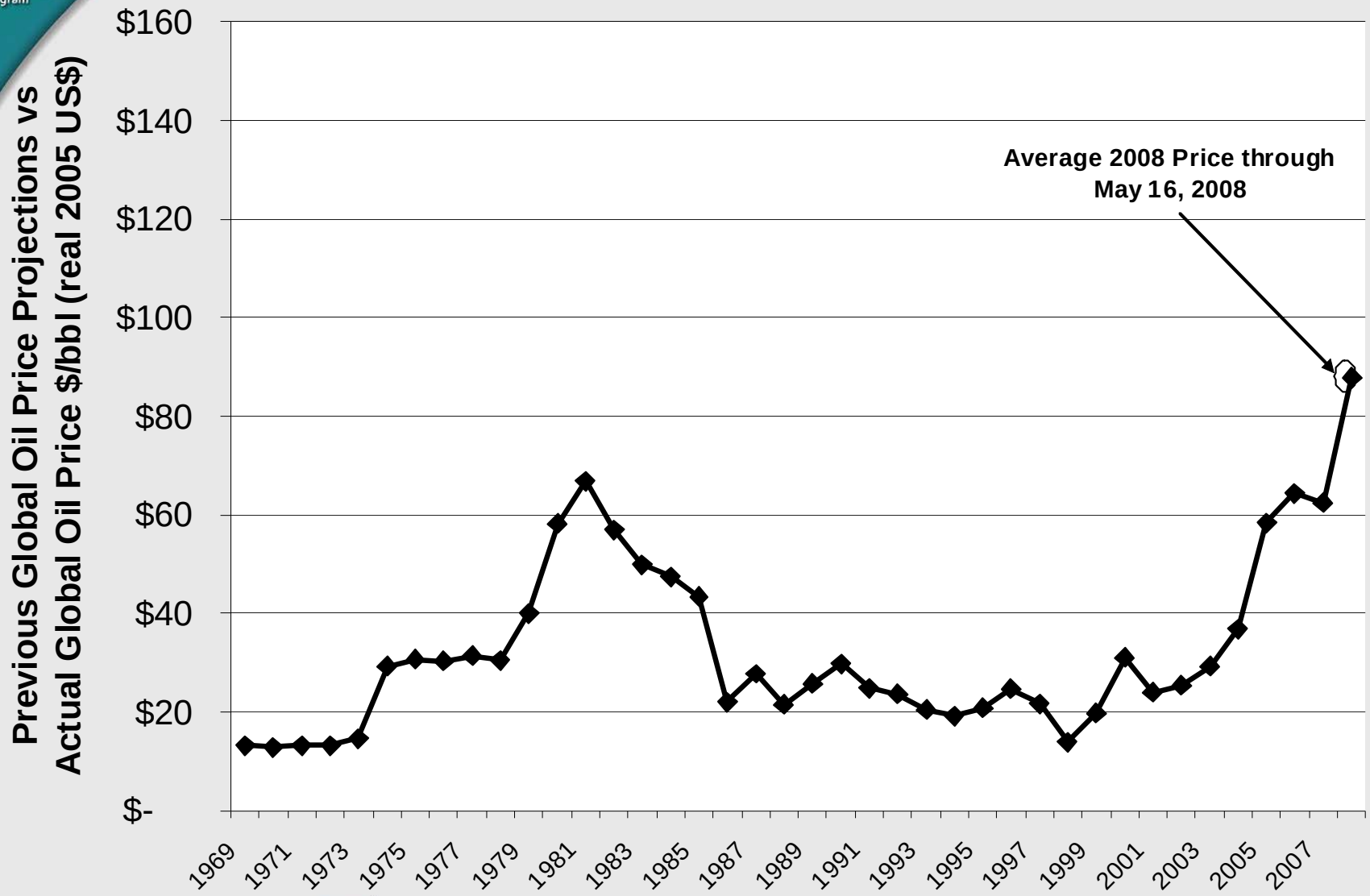
Means of Controlling Real Costs

There needs to be a credible expectation that the cost of implementing a commitment will not be too onerous. If sticking with the Commitment is too painful (costly), it will ultimately implode.

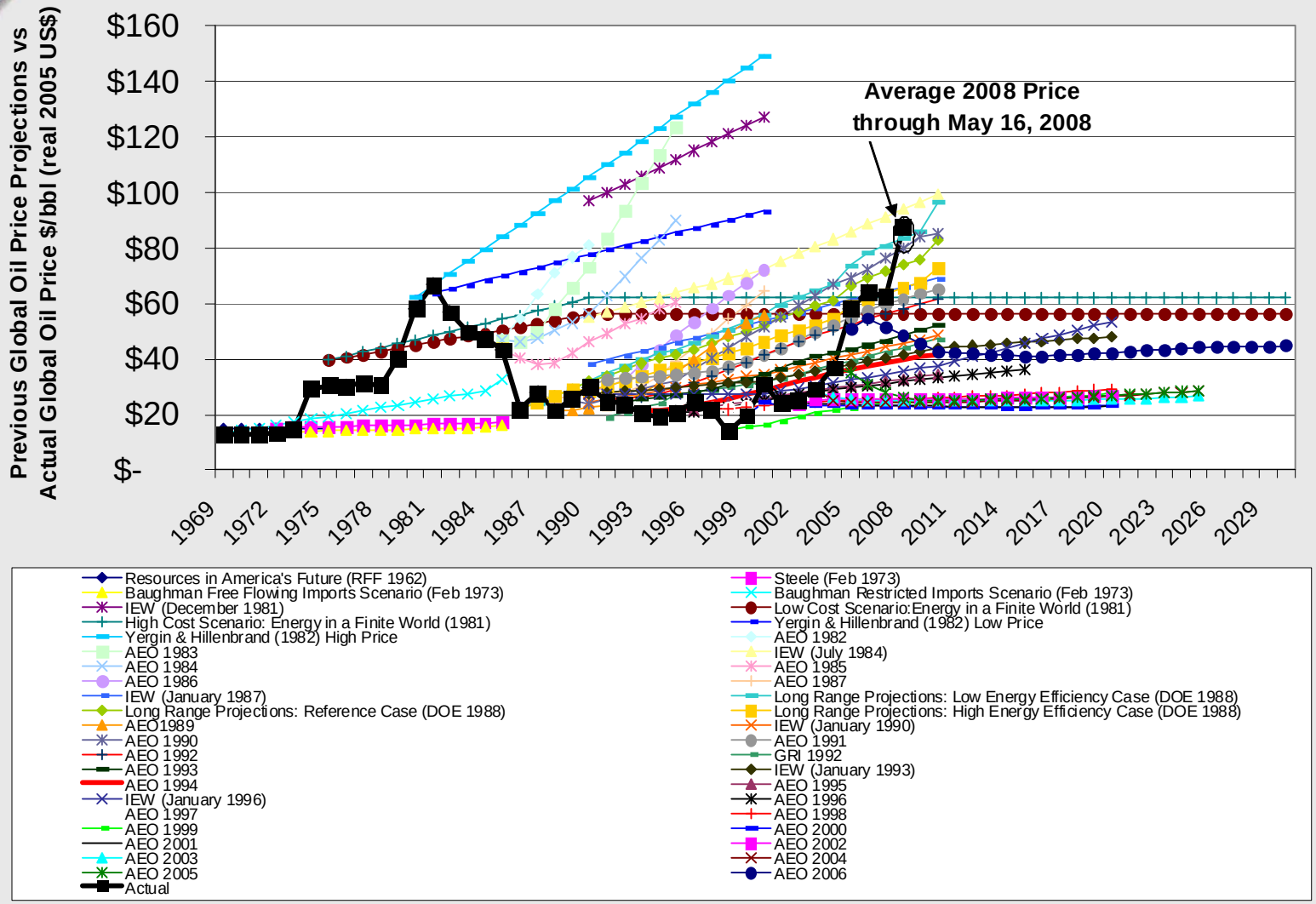
US Oil Prices 1861-2008



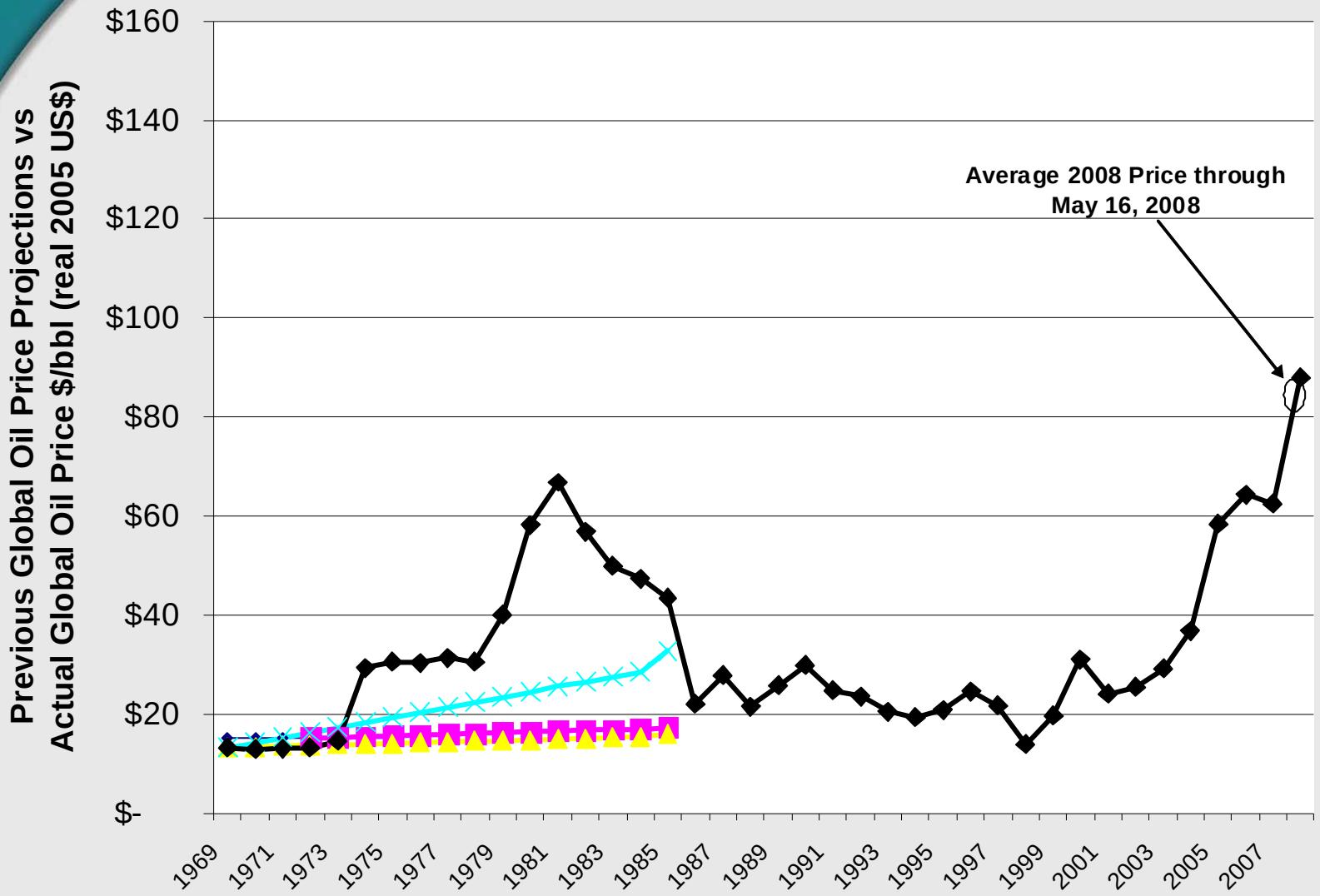
U.S. Oil Prices 1969-2008



History of Oil Price Projections and Actual Oil Price (real 2005 US$)

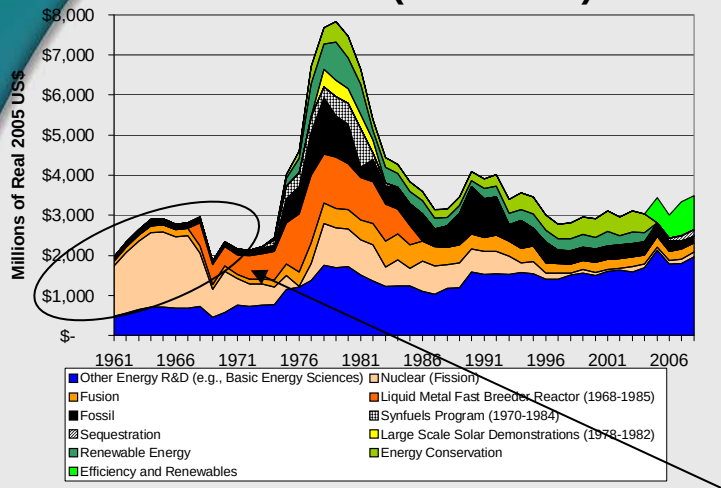


Oil Prices and Projections Pre-1973 Arab Oil Embargo (real 2005 US$)

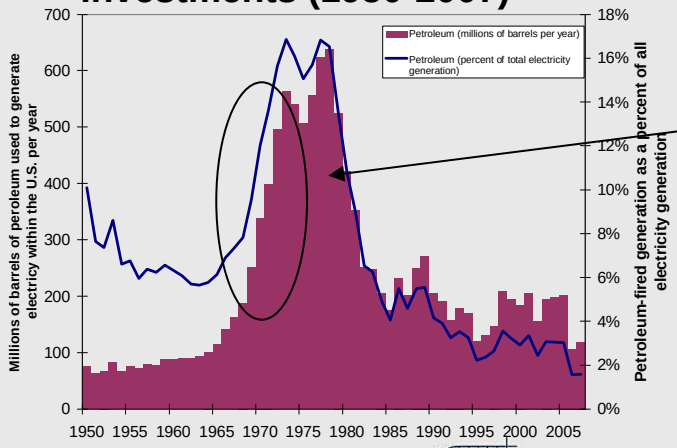


Expectations and Incentives Matter: Pre-1973 Arab Oil Embargo

Federal Energy R&D Investments (1961-2008)



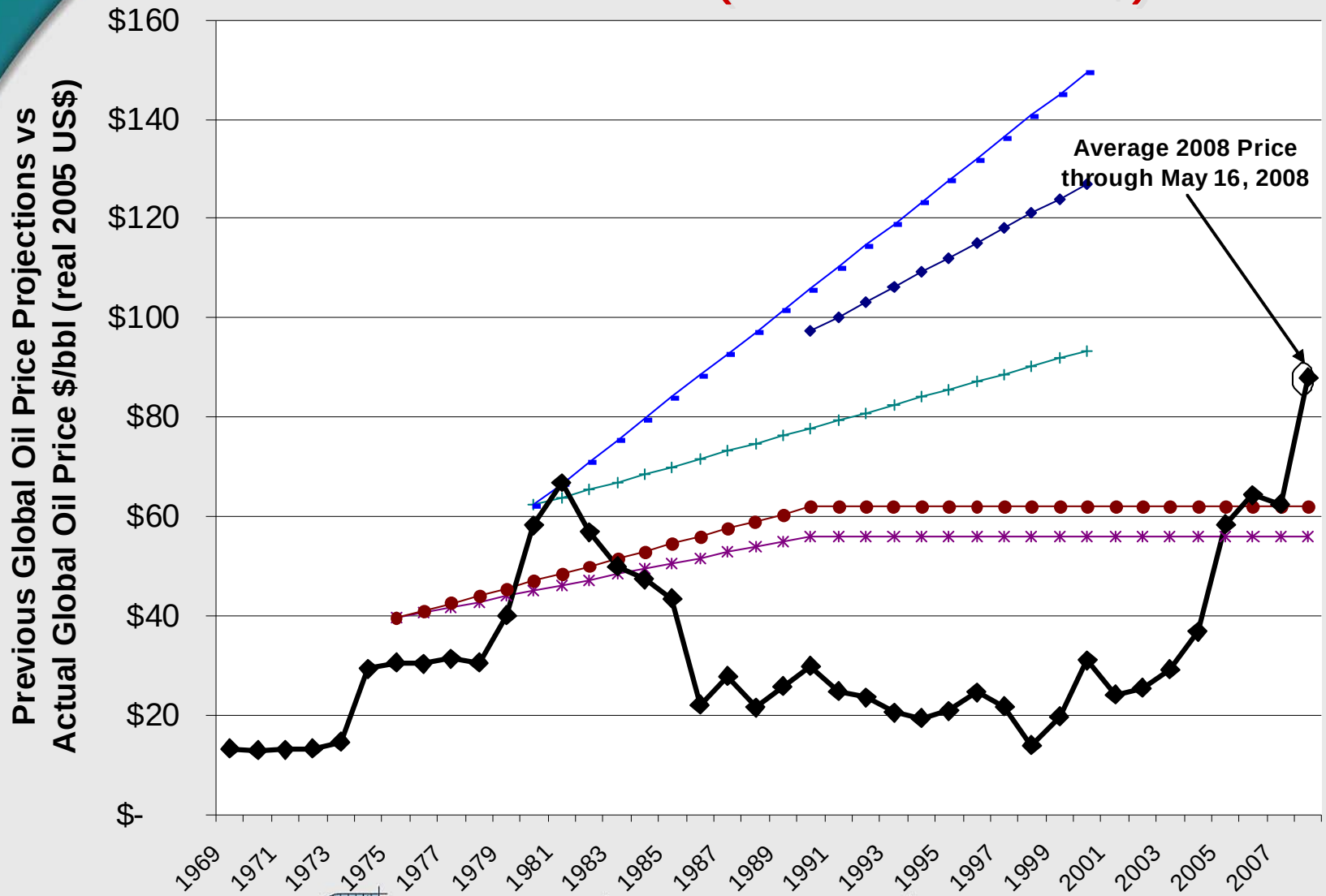
U.S. Oil-fired Electric Generation Investments (1950-2007)



Federal investments in energy R&D were stable or in decline and were overwhelmingly focused on nuclear power.

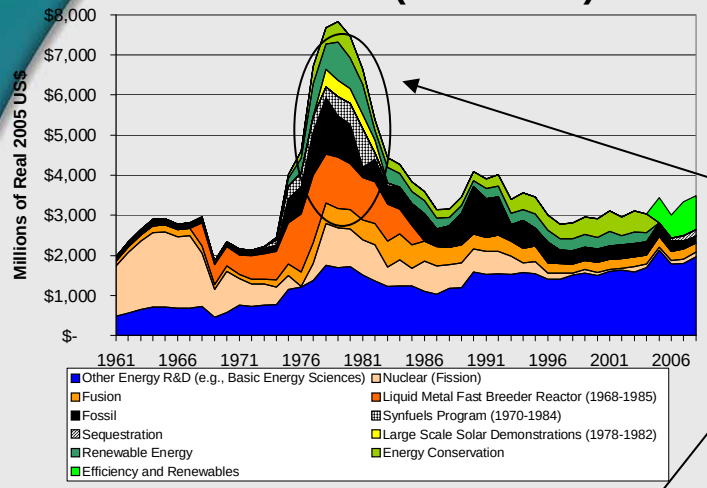
The electric utility sector was rapidly expanding its use of (cheap) petroleum.

Oil Prices and Projections Made Between the Major Oil Disruptions of the 1970s (real 2005 US$)



Expectations and Incentives Matter: Between the Major Oil Disruptions of the 1970s

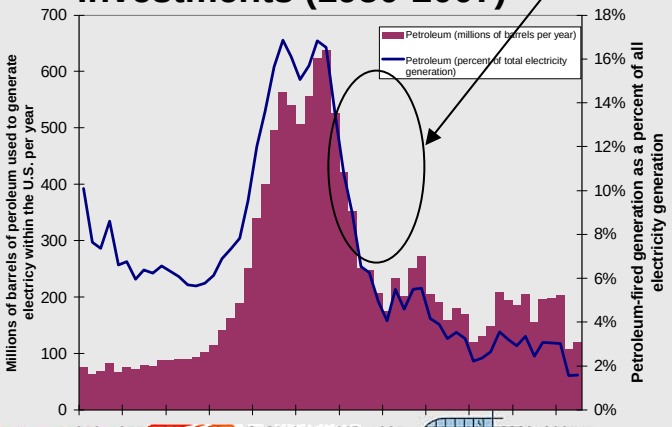
Federal Energy R&D Investments (1961-2008)



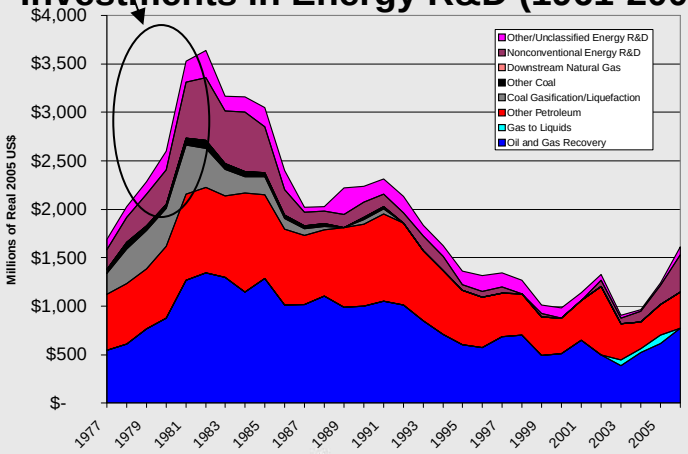
Federal and private sector investments in energy grew dramatically and became a more well rounded portfolio of activities.

Electric utilities quickly reversed course and rapidly decreased their use of petroleum.

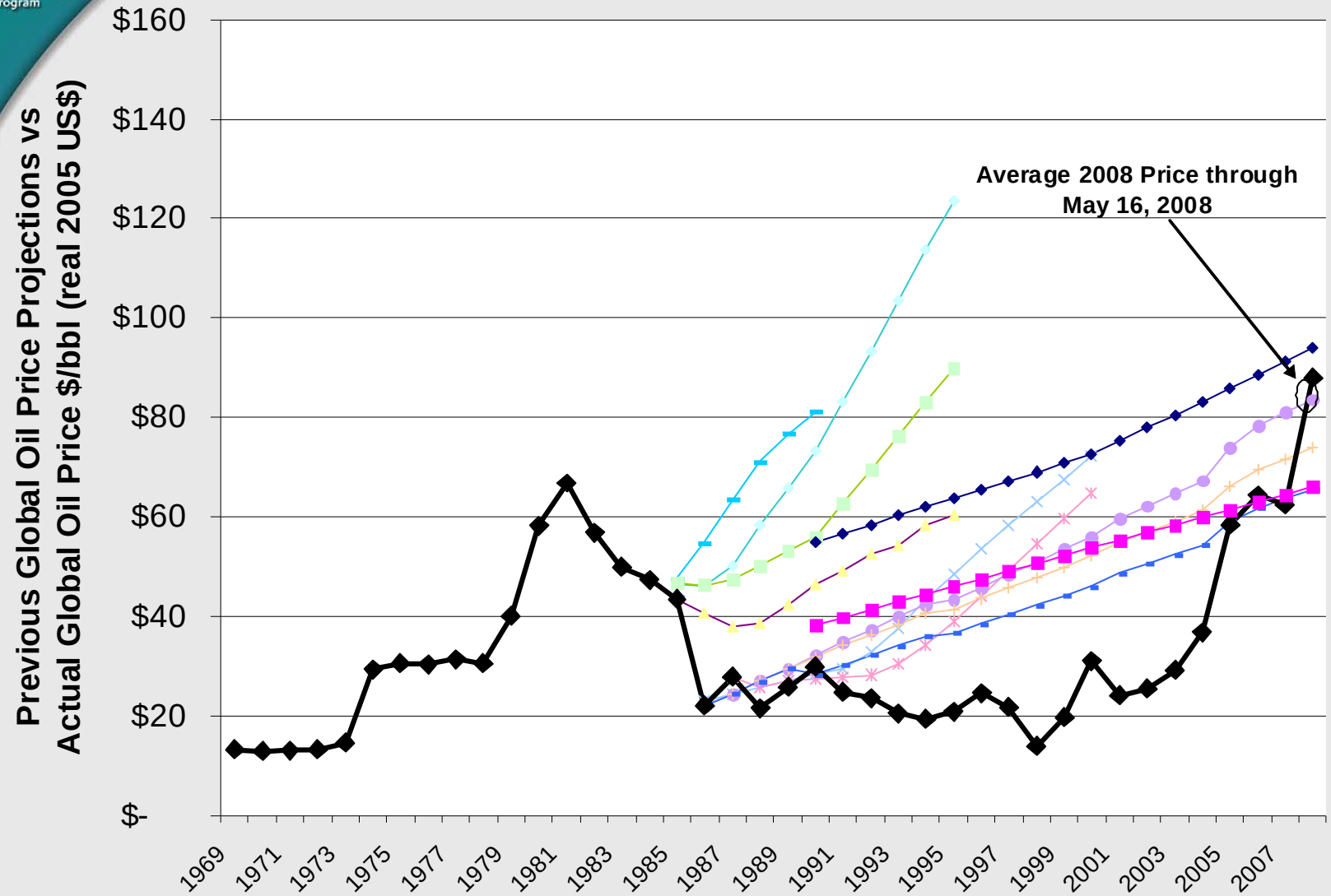
U.S. Oil-fired Electric Generation Investments (1950-2007)



Major US Oil and Gas Companies Investments in Energy R&D (1961-2008)



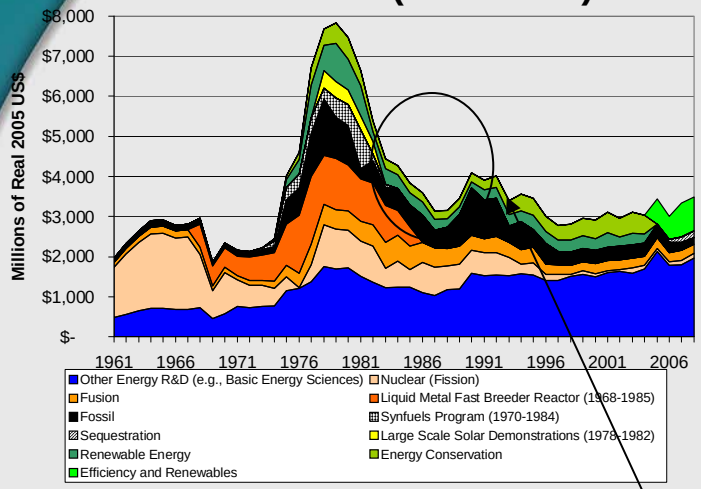
Oil Prices and Projections 1980s (real 2005 US$)



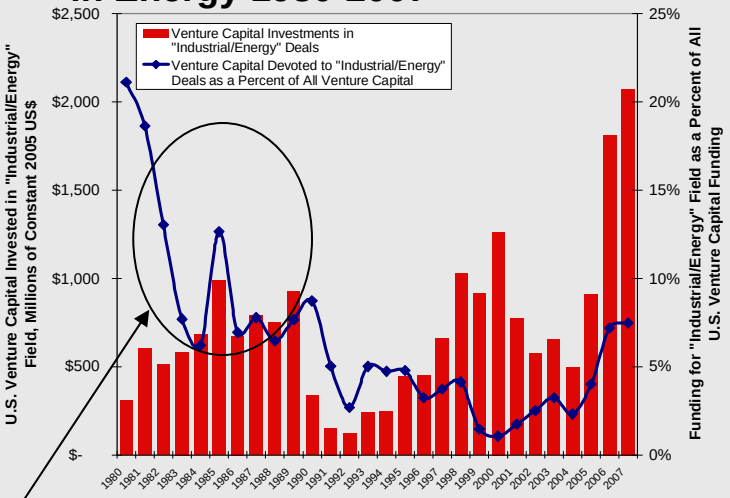
Expectations and Incentives Matter: The 1980s

GTSP
Global Energy Technology Strategy Program

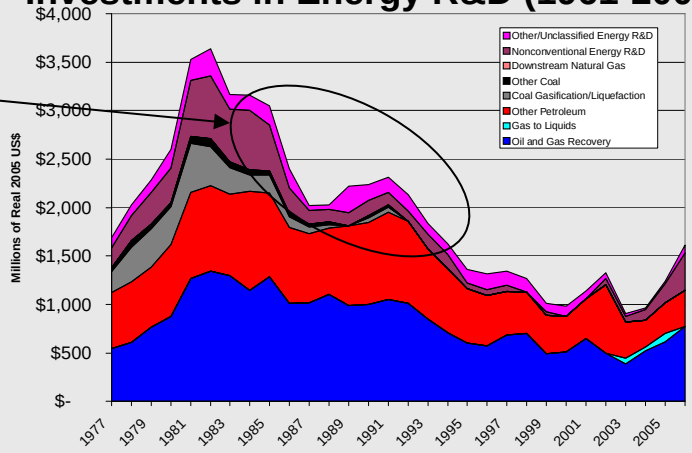
Federal Energy R&D Investments (1961-2008)



U.S. Venture Capital Investments in Energy 1980-2007



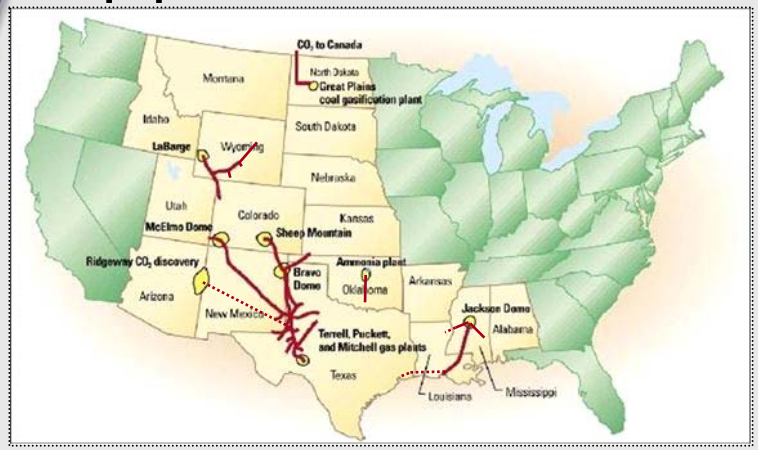
Major US Oil and Gas Companies Investments in Energy R&D (1961-2008)

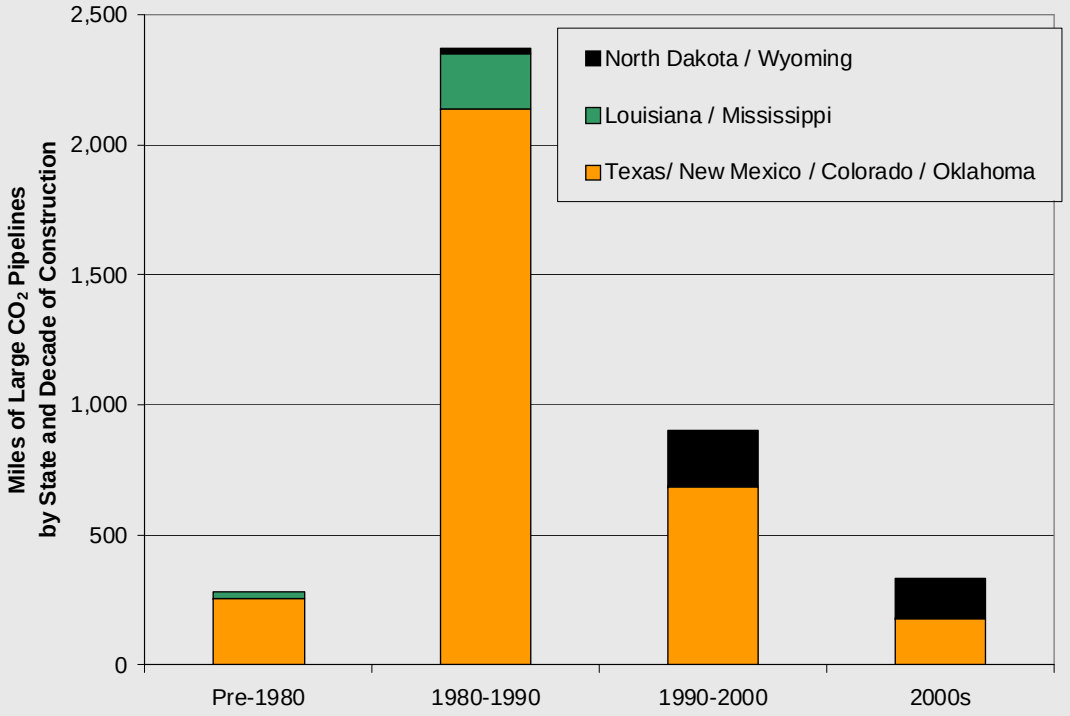


As time passed and the oil disruptions of the 1970s faded into memory, the less priority was accorded to investments in new energy technologies.

Expectations and Incentives Matter: The 1980s

3,900 miles of CO_2 pipeline built to date

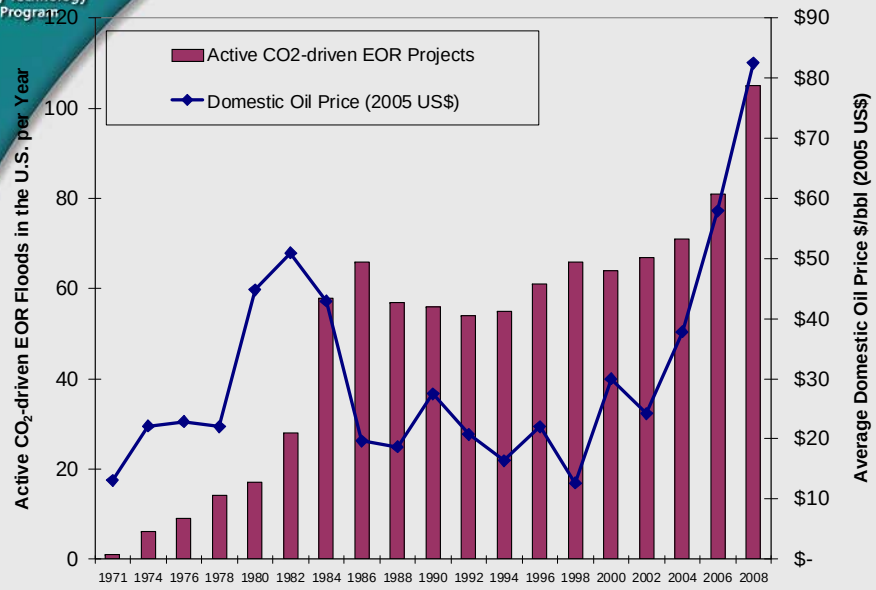


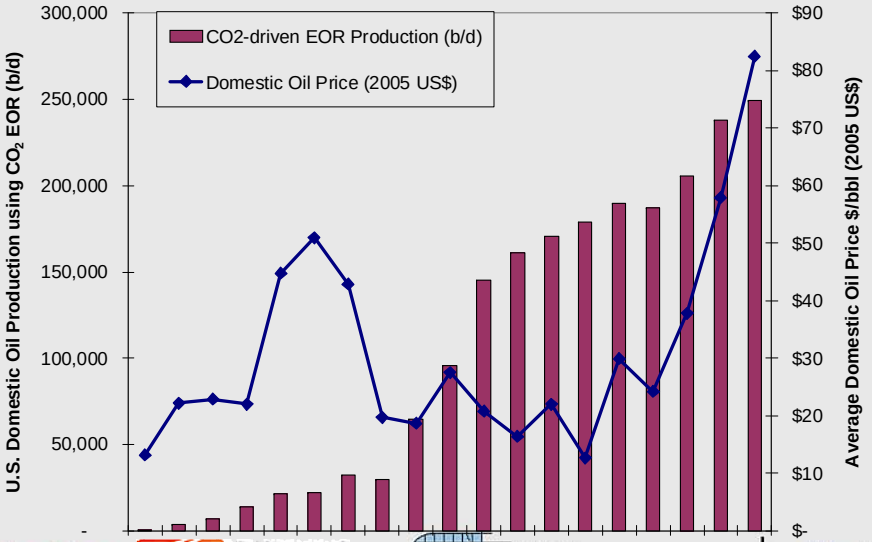


>60% of this was built in the 1980s

>50% was built in and around West Texas in the 1980s

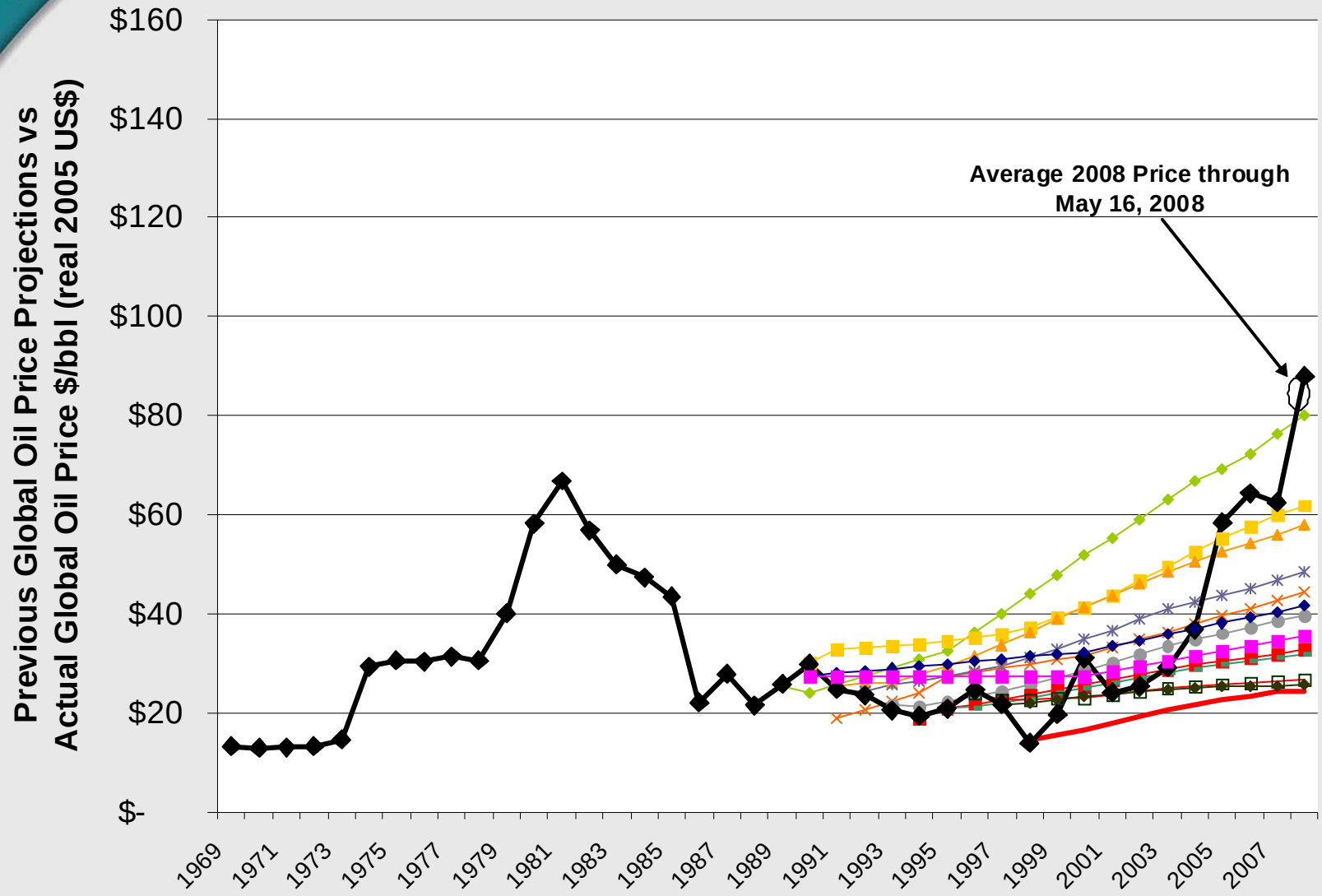
Expectations and Incentives Matter: The 1980s





- Most of the existing CO_2 pipeline infrastructure was built during a period of rapidly declining oil prices.
- This was in part due to the fact that the federal government was sending a clear signal that it would support domestic oil production and that this support would not be short-lived:
  - During the relatively short period 1980-1985, major U.S. oil companies paid over $88.5 billion in Windfall Profits Taxes to the U.S. Government.
- It was also due to the fact that their was a widely held belief that oil prices would begin to increase in the near future.

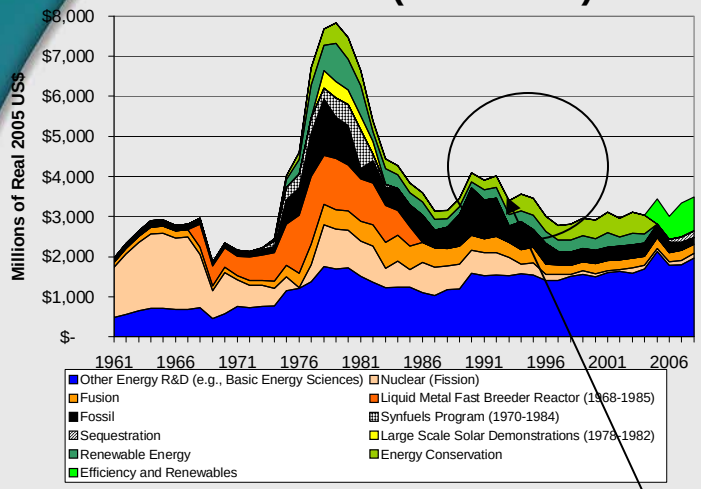
Oil Prices and Projections 1990s (real 2005 US$)



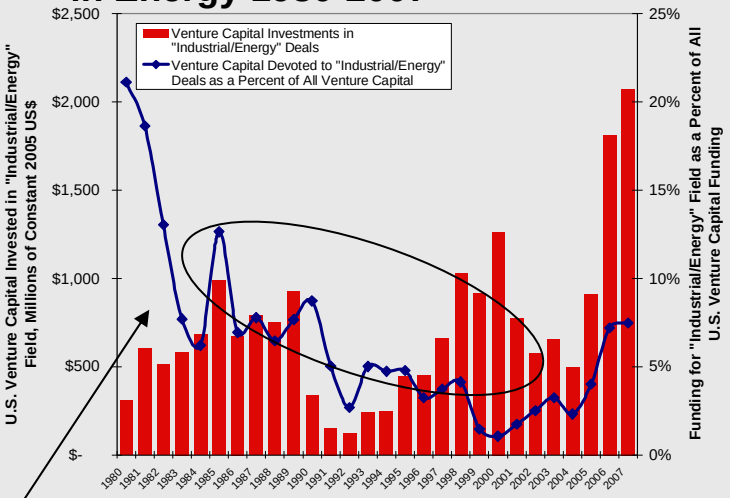
Expectations and Incentives Matter: The 1990s

GTSP
Global Energy Technology Strategy Program

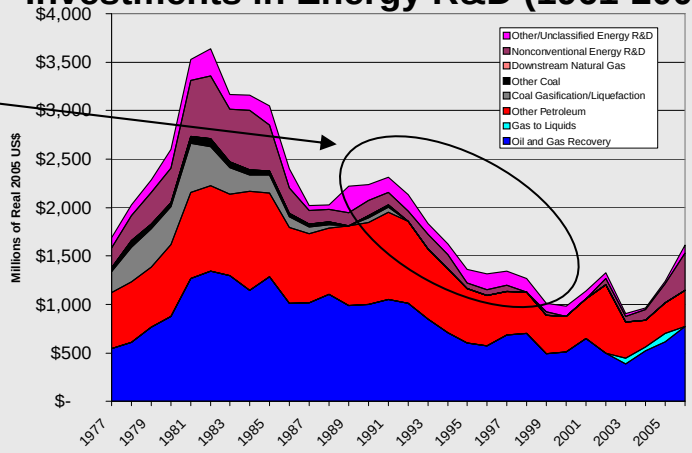
Federal Energy R&D Investments (1961-2008)



U.S. Venture Capital Investments in Energy 1980-2007

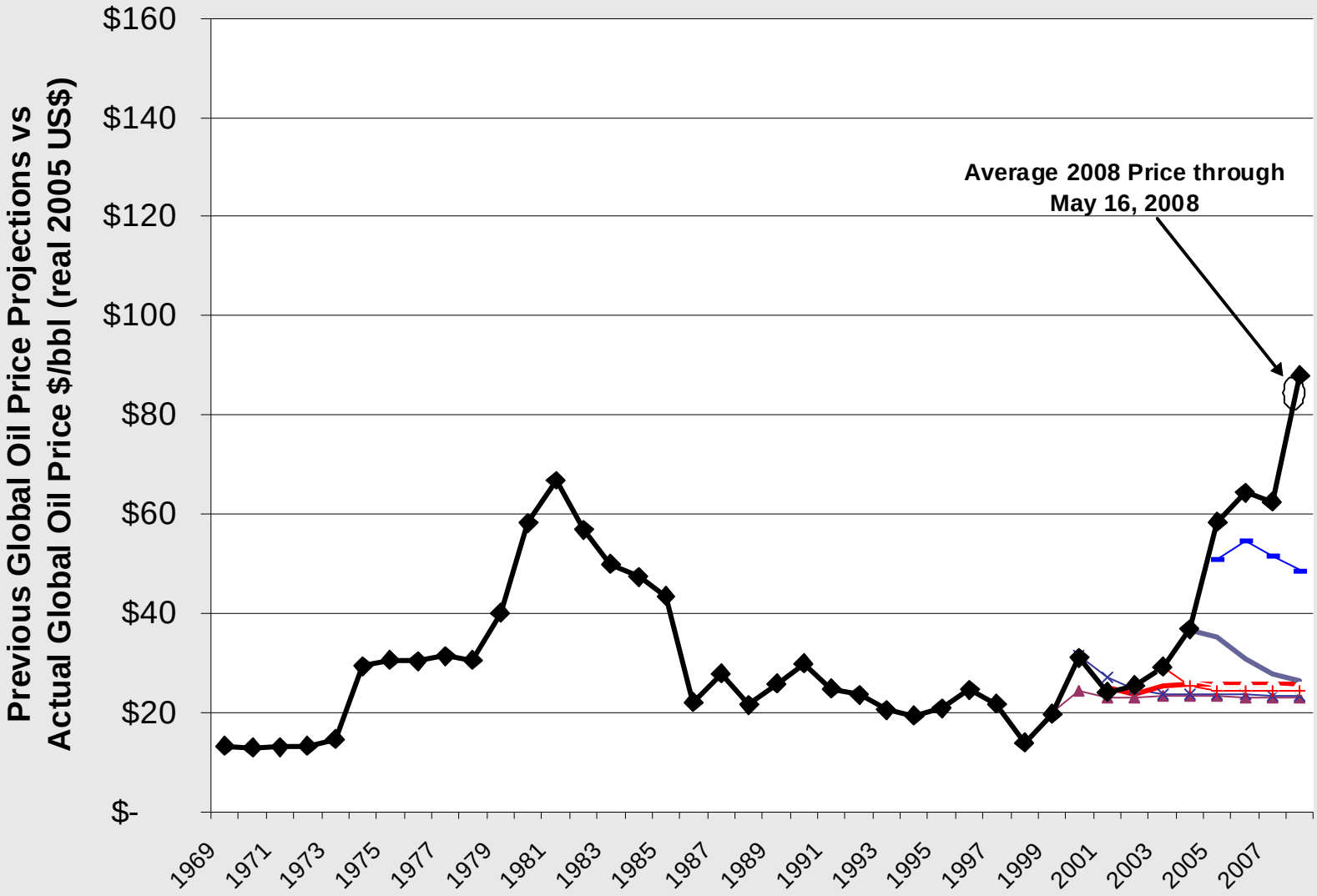


Major US Oil and Gas Companies Investments in Energy R&D (1961-2008)

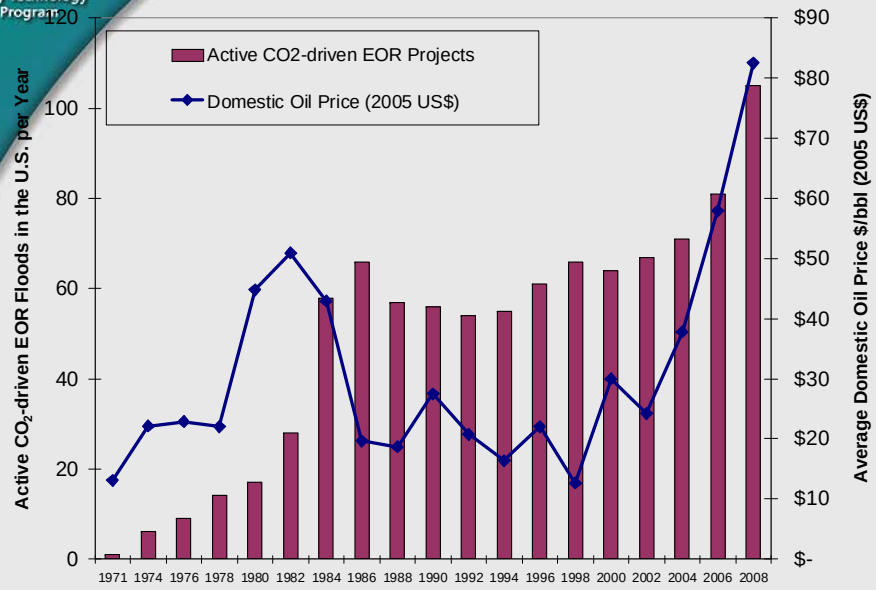


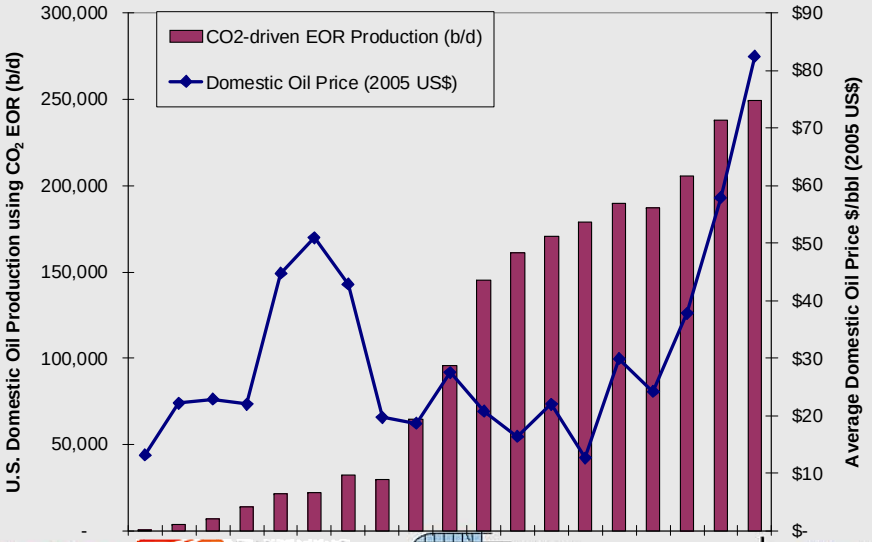
As time passed and the oil disruptions of the 1970s faded into memory, the less priority was accorded to investments in new energy technologies.

Oil Prices and Projections 2000s (real 2005 US$)



Expectations and Incentives Matter: The 2000s

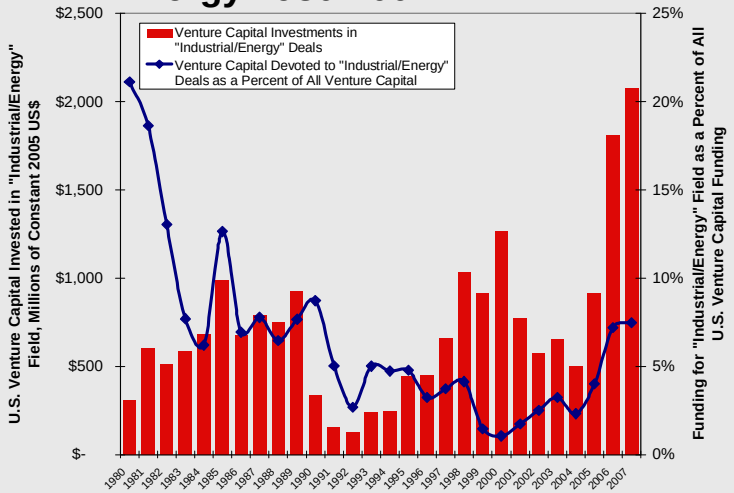




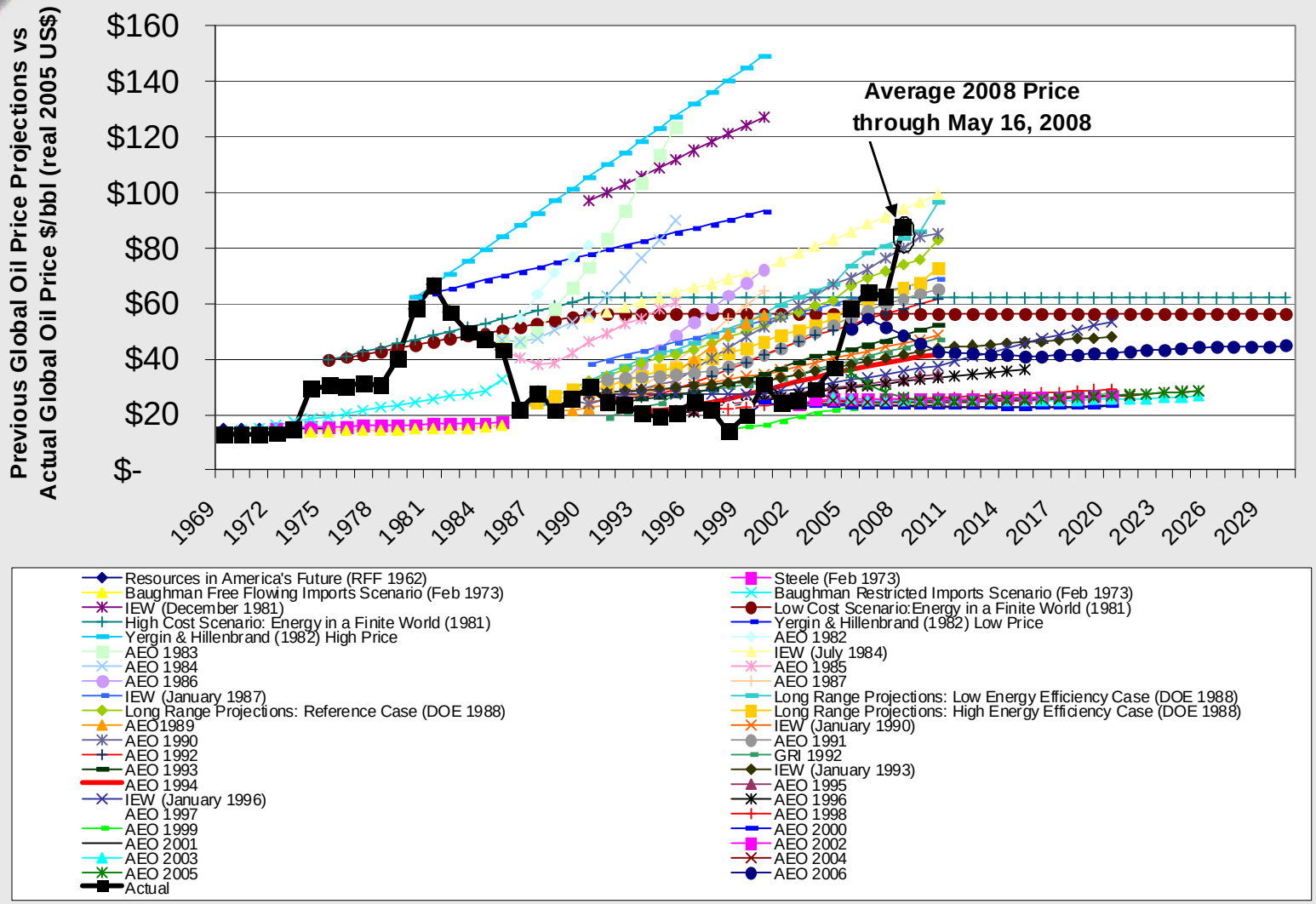
CO_2-driven EOR on the upswing.

More venture capital is being devoted to “energy” investments.

U.S. Venture Capital Investments in Energy 1980-2007



History of Oil Price Projections and Actual Oil Price (real 2005 US$)

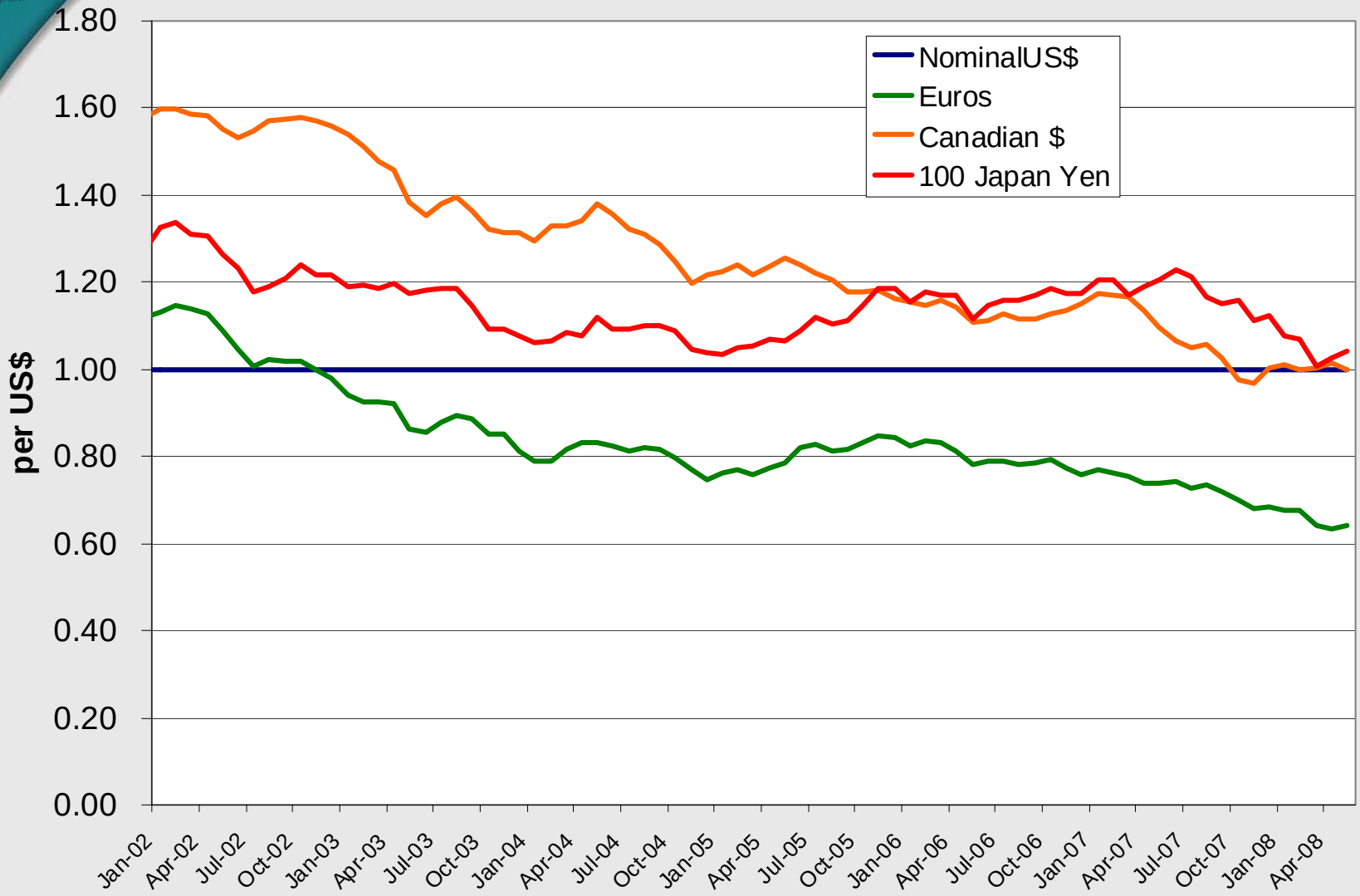


GTSP

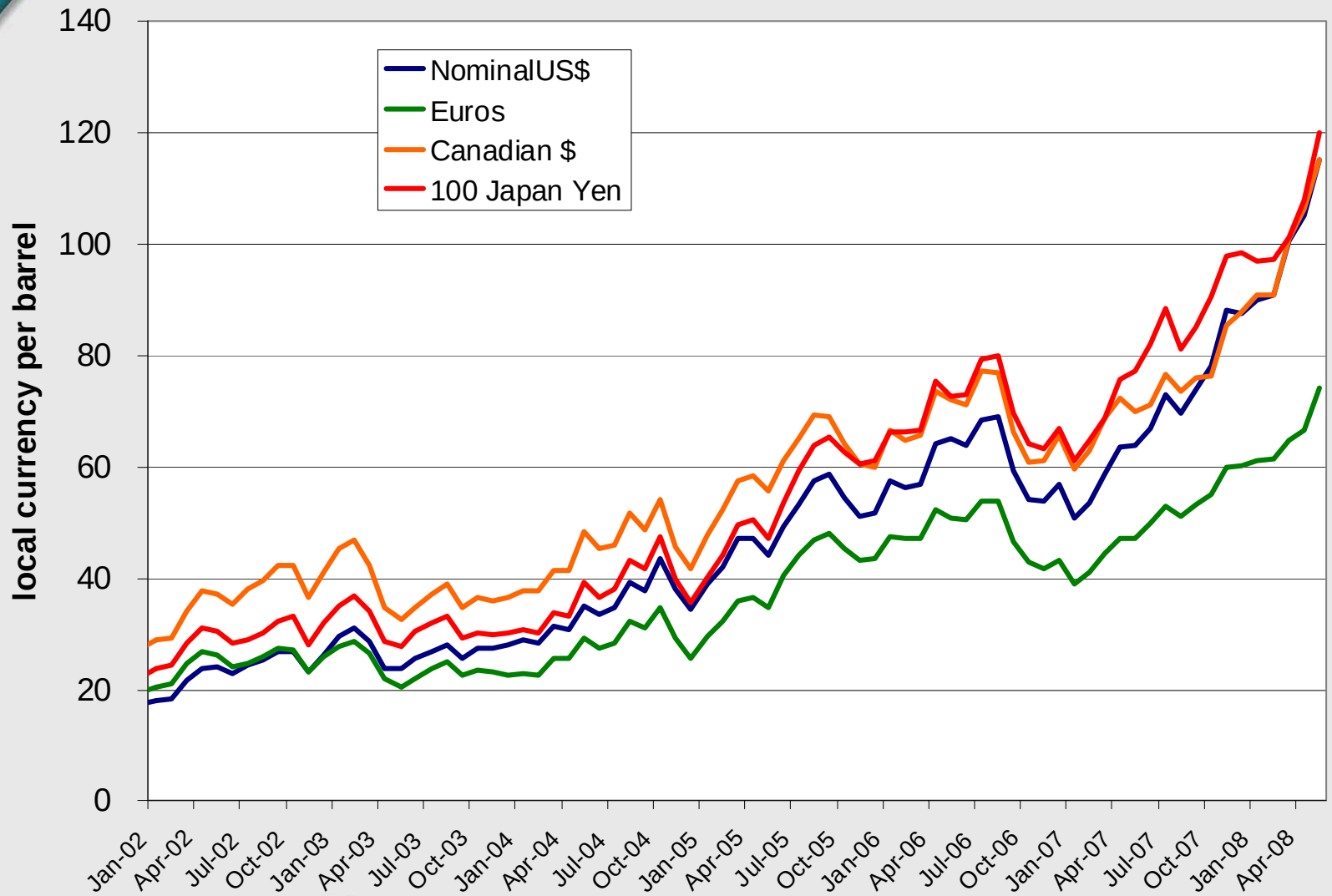
Global Energy Technology Strategy Program

The Recent History of World Oil Prices in Local Currencies

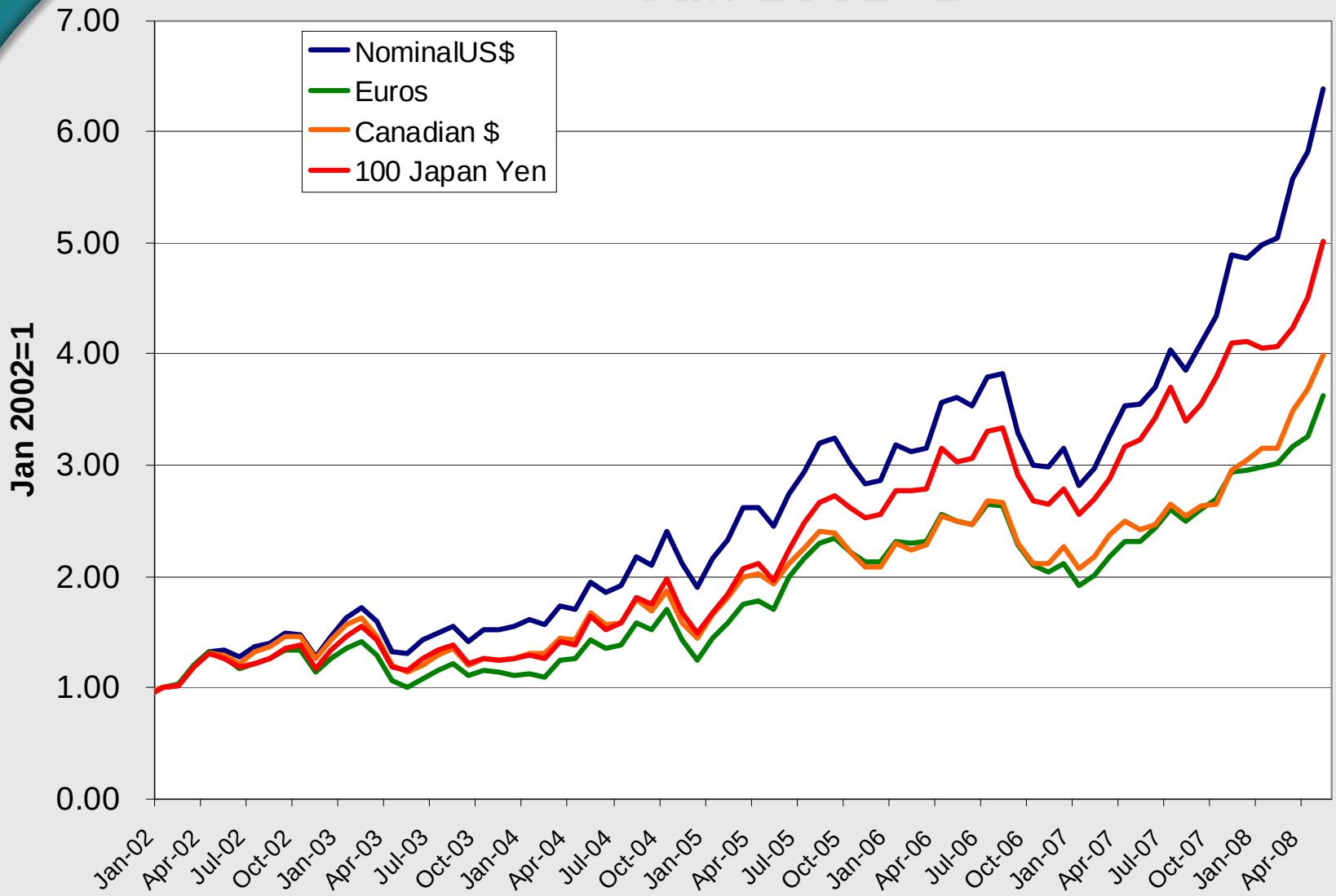
Selected Currency Exchange Rates 2002-2008



World Oil Prices 2002-2008 Expressed in Local Currencies



World Oil Prices in Local Currency Jan 2002=1



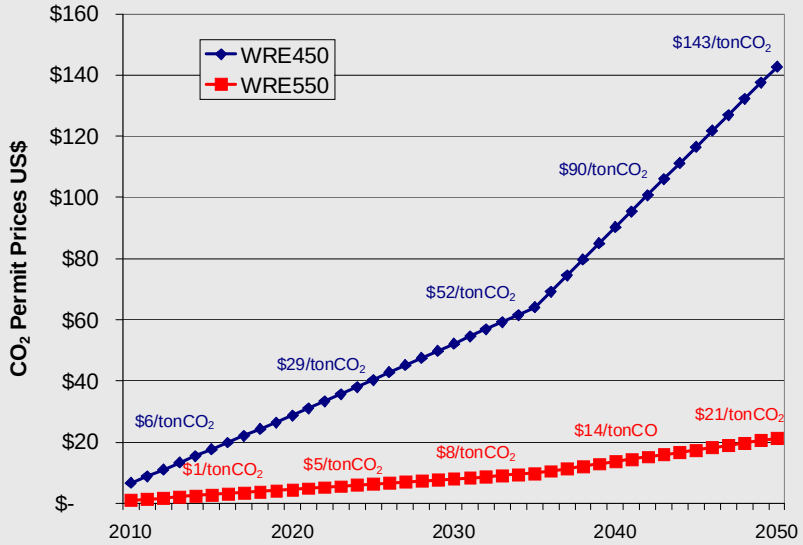
Two Core Principals for Good Guide Climate Policy (Edmonds, 1999)

Credible Commitment

There needs to be a credible expectation that the future energy regime will be different than the past. Technology maturation cycles are significantly longer than political cycles, the Commitment must be binding and transcend multiple political cycles for non-carbon energy technologies to have a chance of achieving significant market penetration.

Means of Controlling Real Costs

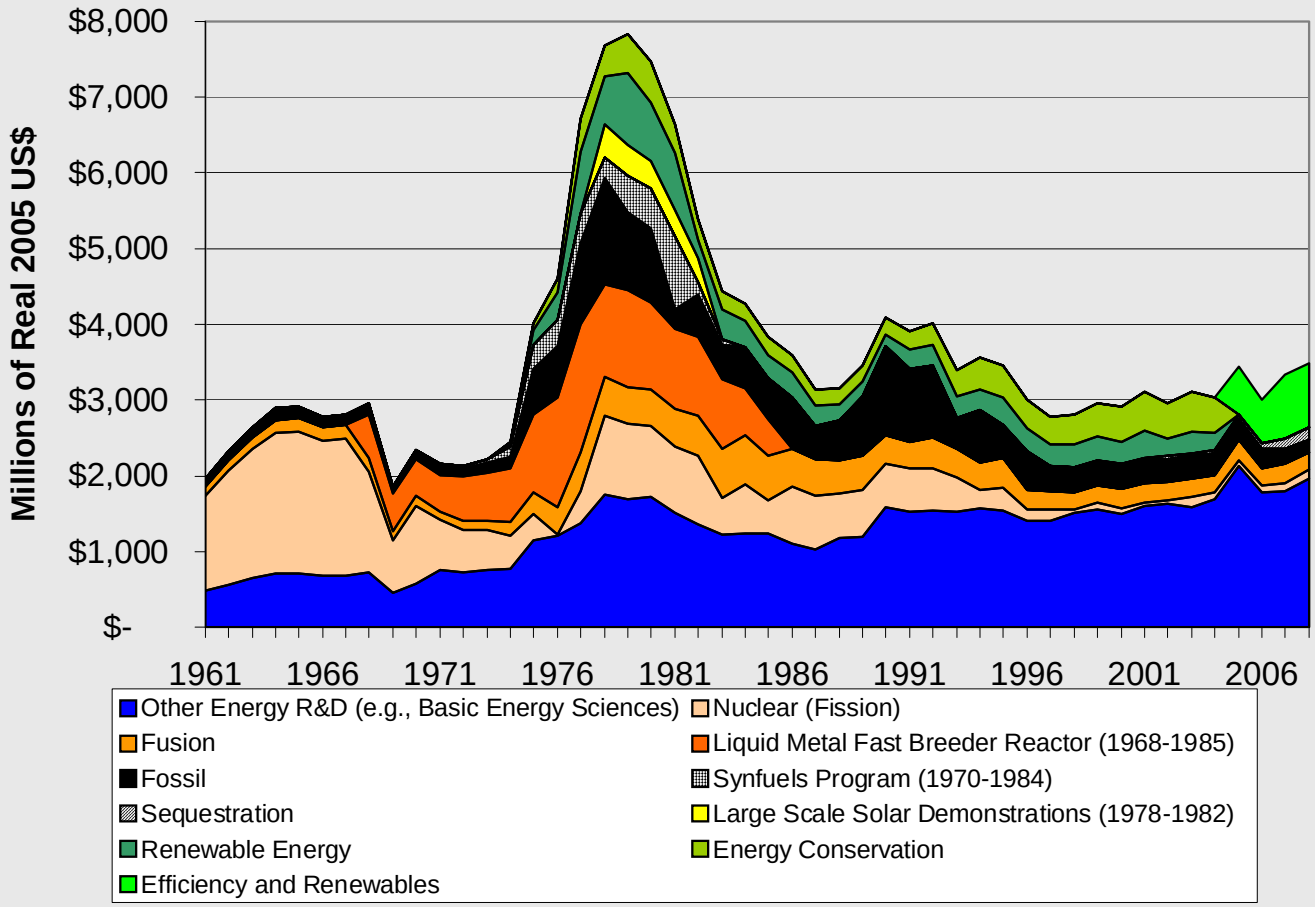
There needs to be a credible expectation that the cost of implementing a commitment will not be too onerous. If sticking with the Commitment is too painful (costly), it will ultimately implode.



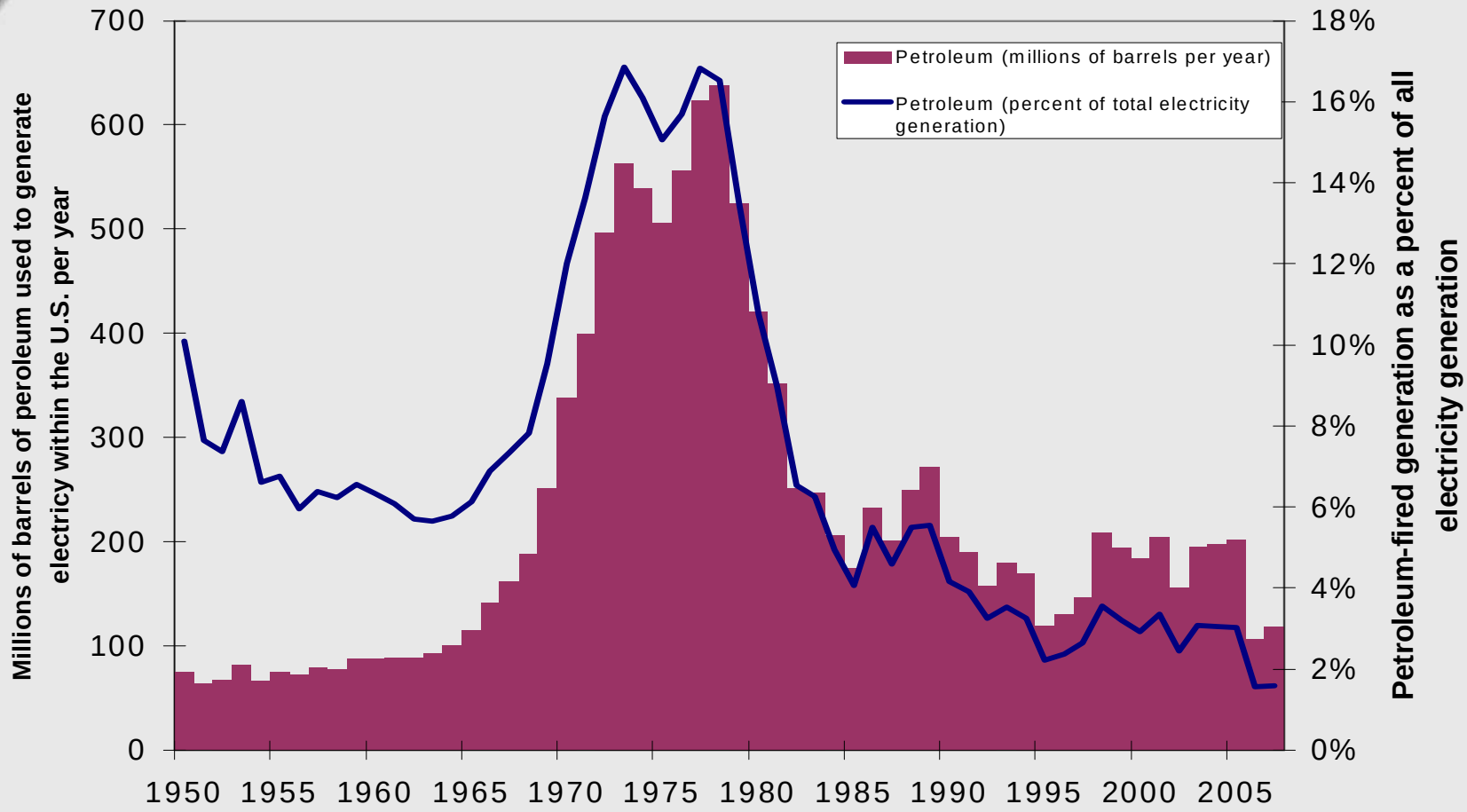
GTSP
Global Energy Technology Strategy Program

Back-up Slides

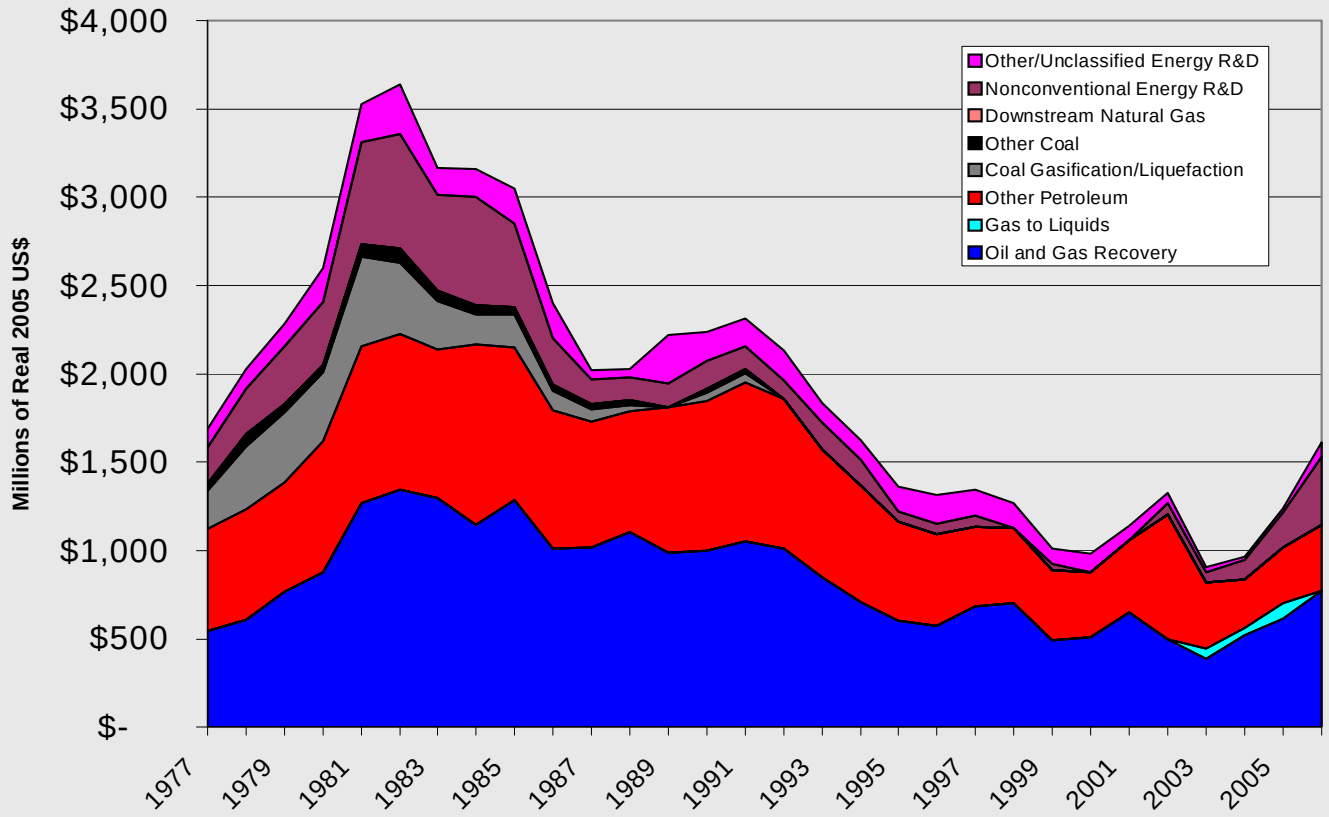
Federal Energy R&D Investments (1961-2008)



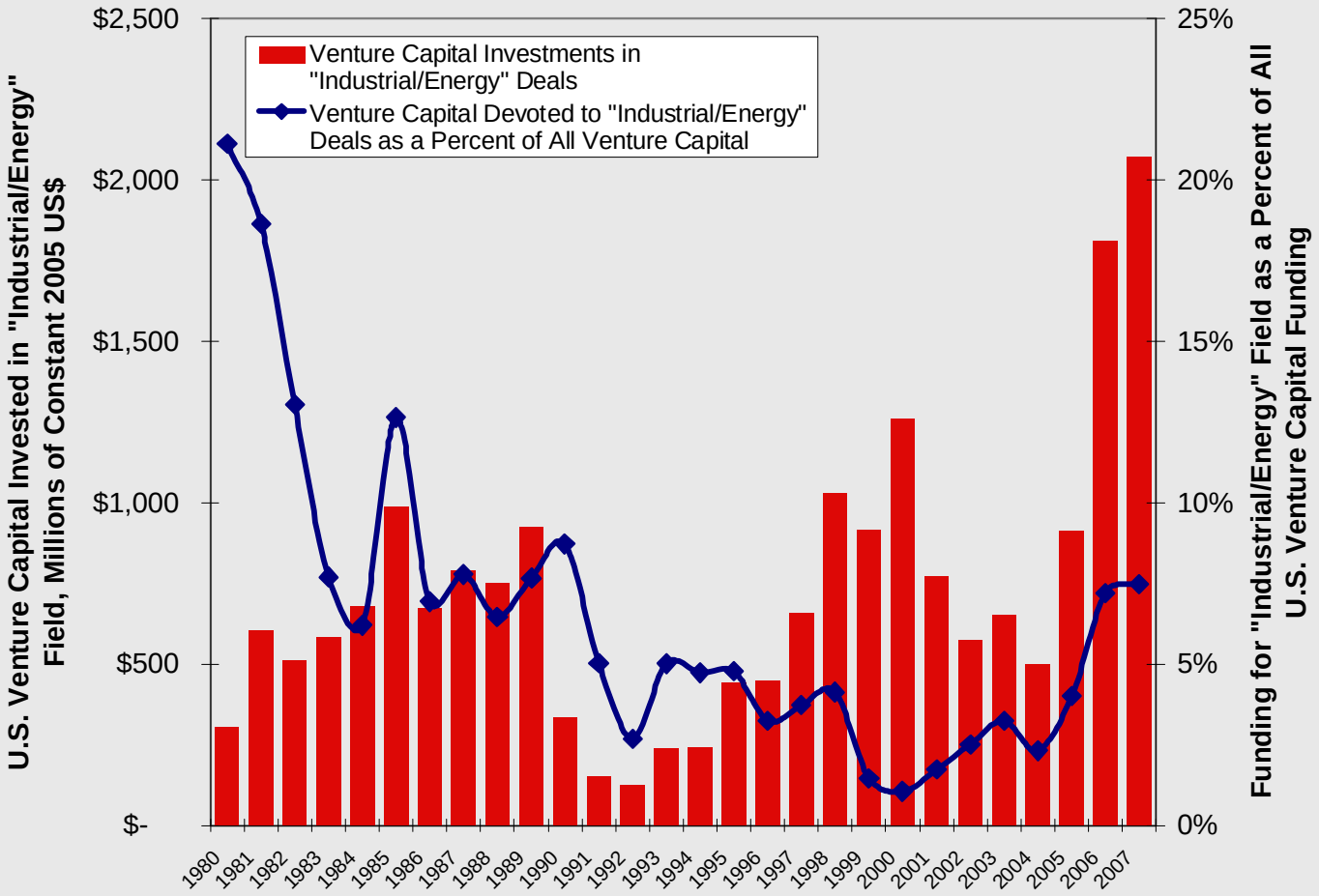
U.S. Oil-fired Electric Generation Investments (1950-2007)



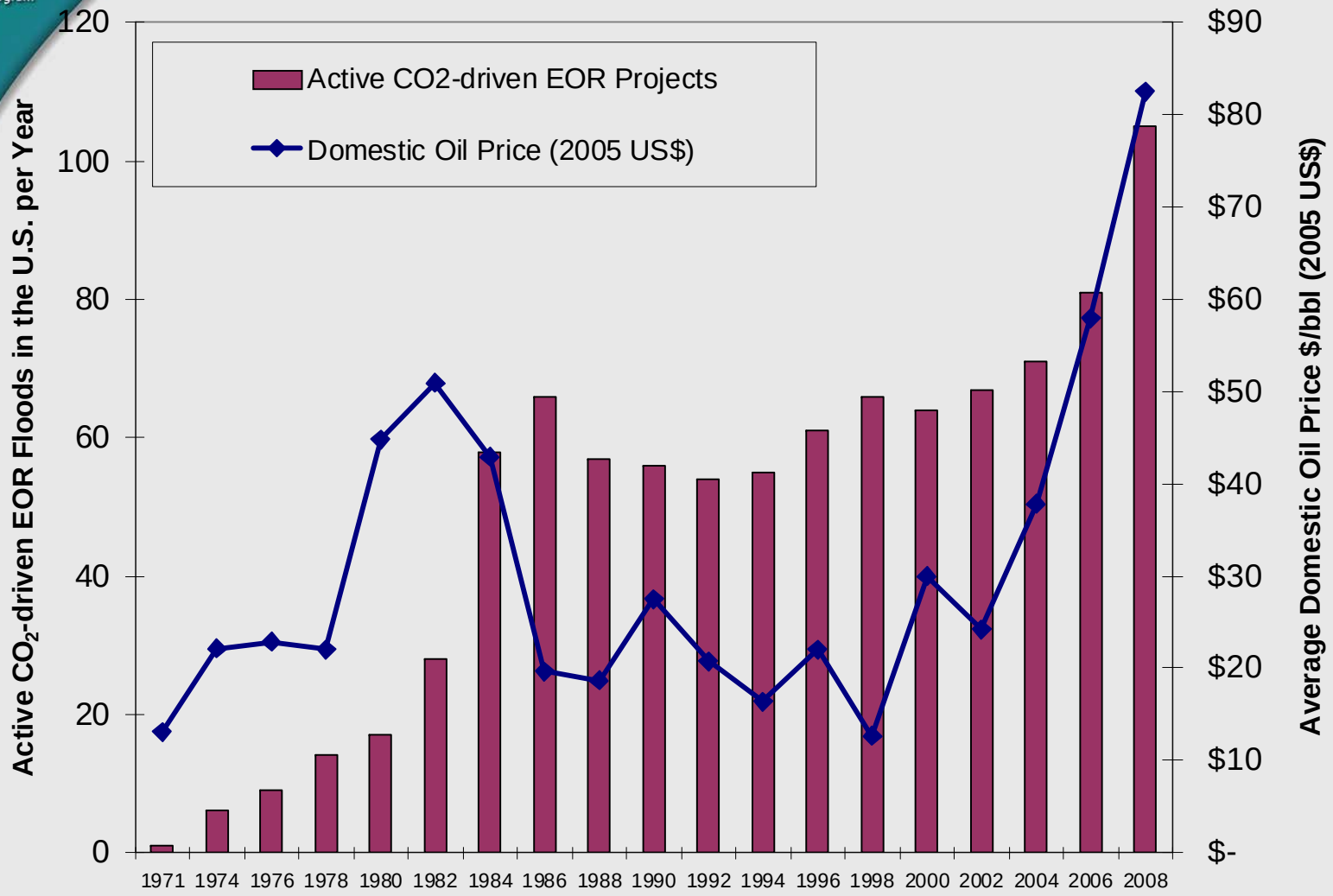
Major US Oil and Gas Companies Investments in Energy R&D (1961-2008)



U.S. Venture Capital Investments in Energy 1980-2007



Number of U.S. CO_2 EOR Floods 1971-2008



Domestic U.S. CO_2 EOR Oil Production 1971-2008